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BY

NETTIE MACGINITIE

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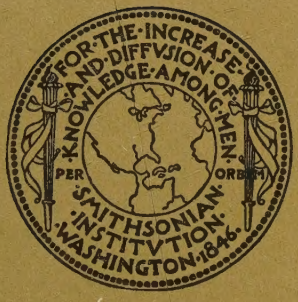

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MARINE MOLLUSCA OF POINT BARROW, ALASKA

By Nettie MacGinitie [1]

Introduction

The material upon which this study is based was collected by G. E. MacGinitie in the vicinity of Point Barrow, Alaska. His work on the invertebrates of the region (see G. E. MacGinitie, 1955) was sponsored by contracts (N6–ONR 243–16) between the Office of Naval Research and the California Institute of Technology (1948) and The Johns Hopkins University (1949–1950). The writer, who served as research associate under this project, spent the periods from July 10 to Oct. 10, 1948, and from June 1949 to August 1950 at the Arctic Research Laboratory, which is located at Point Barrow base at approximately long. 156°41′ W. and lat. 71°20′ N.

As the northernmost point in Alaska, and representing as it does a point about midway between the waters of northwest Greenland and the Kara Sea, where collections of polar fauna have been made, Point Barrow should be of particular interest to students of Arctic forms.

Although the dredge hauls made during the collection of these specimens number in the hundreds and, compared with most "expedition standards," would be called fairly intensive, the area of the ocean

[1] Kerckhoff Marine Laboratory, California Institute of Technology.

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bottom touched by the dredge is actually small in comparison with the total area involved in the investigation. Such dredge hauls can yield nothing comparable to what can be obtained from a mudflat at low tide, for instance. The equipment available was incapable of penetrating the sticky mud to more than a few inches and dredge hauls are literally made in the dark. The results of such dredging cannot possibly compare with results obtained by digging in a mudflat where a practiced eye dictates. Nor can the dredging in the rubble zone compare with collecting along a rubble beach or rocky shore at low tide. Equipment could not bring up large rocks and, as every collector knows, it is the underside of large rocks and the substratum under them that tend to be the most rewarding in rocky shore collecting. Nonetheless, despite the disadvantages of a small boat and unfavorable weather, over 110 species and at least 11 varieties of mollusks were collected.

Previous Work

Members of the International Polar Expedition to Point Barrow, Alaska, 1881–1883 (see Ray, 1885), were stationed near Point Barrow for two years. Their main objective was meteorological work and they were not equipped for dredging operations. Dall (1885b) identified and listed the species of mollusks collected in the vicinity of Point Barrow by this expedition; these total 33 species, plus 2 varieties, over two-thirds of which were shells gathered from the beach. Dall (1919c), who also identified the mollusks collected by the Canadian Arctic Expedition west from Bathurst Inlet, lists 26 species and 3 varieties picked up from the beach in the vicinity of Point Barrow. Actually, this expedition did very little work north of Alaska and western Canada. Various ship captains and expedition leaders took dredge hauls at several points along the Alaskan coast—at Cape Lisburne, Cape Sabine, Point Franklin, and Icy Cape, for example—but no one attempted to make a study of any one particular area. In fact, the majority of the Alaskan work was done south of Bering Strait.

Extent and Character of the Area Investigated

The G. E. MacGinitie collection was made largely in an area extending offshore in a northwesterly direction from Point Barrow base, which is 6 miles southwest of Point Barrow. Only one station (16 miles offshore) was more than 12 miles from shore, and the majority of stations were less than 6 miles from shore. An open coast, weather conditions, and a small boat precluded making many dredge hauls beyond 6 miles from shore, and dredging stations did not cover an alongshore distance much in excess of 6 miles. Dredge hauls were also made at Eluitkak Pass, the entrance to Elson Lagoon, a long,

shallow, barren lagoon extending along the coast southeast of the Point.

The beach at Point Barrow base consists largely of fine gravel, with an occasional narrow strip of sand or admixture of sand and gravel. The gravel extends out to a depth of 10 to 20 feet. This gravel zone is succeeded by the mud zone of fine, blue, sticky mud, so tenacious that clam shells such as *Macoma* have to be scrubbed individually to free them of mud. A dredge haul from this zone cannot be washed by dragging the dredge behind the boat; the mud has to be worked over by hand for its contained specimens. At a depth of about 100 feet, the mud zone is replaced by the rubble zone in which the bottom may be covered by pebbles and stones from the size of a walnut to small boulders. The bottom in the rubble zone is rather spotty, for there may be areas of mud or of gravel much beyond the depth of 100 feet, or there may be admixtures of mud, gravel, and stones in about equal quantity or in any proportion. Mud areas in the rubble zone consist of mud that is much less sticky than that of the mud zone.

About 12.1 miles from shore G. E. MacGinitie (1955, p. 71) discovered a canyon about a quarter of a mile across, the bottom of which (at dredging station 32) was 741 feet deep. On the shoreward side of this canyon the floor of the ocean was at a depth of 438 feet and on the oceanward side it was 522 feet deep. The bottom of this canyon was covered with mud and a mass of worm tubes, largely of *Pista maculata*.

Stations in the rubble zone are subject to almost yearly change, brought about by the deposition of mud from eroding shores. When the ice goes out and remains far offshore as it did in the summers of 1949 and 1950, wind storms create high surf with consequently greater erosion alongshore than when floating ice remains near shore as it did during the entire summer of 1948. Floating ice tends to dampen the effect of wind on waves and surf.

The reader should bear in mind that there are no tidal zone animals at Point Barrow. Usually in October, ice begins to form alongshore and the ocean freezes over out to a distance of several miles and seldom breaks up and leaves before about July 20. The tide apparently does not exceed 6 inches, although there may be wind tides of 3 feet or more during storms. Hence, the only "shore collecting" consists of gathering any specimens that may be washed ashore during storms in summer and early autumn. During the summer of 1948, almost no animals were washed ashore.

Even in summer the molluskan species at Point Barrow seldom experience a temperature above freezing, for the freezing point of salt water is lower than 32° F.

Dredging Stations

Table 1, below, is taken from G. E. MacGinitie (1955, pp. 62–63). Fifty-two of these stations were at depths of less than 225 feet and only six exceeded 400 feet. Stations 29 and 30–31 represent the shoreward and oceanward floors, respectively, bordering the submarine canyon mentioned above. Eluitkak Pass is a unique station in that although it is only 35 to 40 feet deep, it is covered with rubble and with mud and gravel admixed, and it supports a fauna found at other stations at depths of not less than 110 feet. The most striking difference between the fauna of Eluitkak Pass and that of rubble bottom stations at depths of 110 to 200 feet is the absence of echinoderms and chitons at the Pass, this absence no doubt being due to dilution by fresh water

Table 1.—*Dredging stations*

No.	Date	Depth in feet	Type of bottom and remarks
1	7–20–48	10	Gravel
1a	7–26–48	22	Mud
2	7–26–48	50	Mud
3	8– 2–48	30	Mud
4	8– 6–48	40	Stones, mud, gravel (Eluitkak Pass)
5	8– 9–48	10–20	Gravel (alongshore from base to village)
6	8–10–48	40	Stones, mud, gravel (Eluitkak Pass)
7	8–21–48	80	Gravel
8	8–21–48	100	Gravel, small stones
9	8–21–48	140	Small stones (up to 4 inches), gravel
10	8–23–48	150	Gravel, small stones
11	8–23–48	20	Mud
12	8–30–48	40	Eluitkak Pass
13	9– 2–48	40	Eluitkak Pass
14	9– 8–48	110	Incomplete haul; rough current and wind
15	9– 8–48	60	Mud (out from radio masts)
16	9– 8–48	15	Sandy (out from radio masts)
17	9– 9–48	80	Mud
18	9– 9–48	100	Mud
19	9– 9–48	110	Mud, gravel
20	9– 9–48	125	Stones (sea urchins, *Psolus*, sea anemones)
21	9–15–48	110	Stones, mud, gravel (*Psolus*, sea anemones)
22	9–15–48	120	Stones (*Psolus*)
23	9–15–48	130	Stones (sea anemones, *Psolus*, sea urchins)
24	9–16–48	110	Shells, pebbles, mud
25	8– 8–49	120	Gravel, stones (large), mud
26	8– 9–49	130	Stones, gravel
27	8– 9–49	420	Stones, gravel
28	8– 9–49	70	Mud
29	8–17–49	438	Stones
30–31	8–17–49	522	Stones (sea urchins)
32	8–17–49	741	Mud (worm tubes)
33	8–30–49	184	Stones, boulders (*Psolus* and sea urchins—many)
34	8–30–49	30	Mud
35	9– 1–49	328	Gravel (coarse), stones (few large)
36	9– 6–49	477	Rocks (few) (worm tubes)
37	9– 6–49	217	Stones, large perforated rocks
38	9– 8–49	246	Pebbles, gravel, mud

TABLE 1.—*Dredging stations*—Continued

No.	Date	Depth in feet	Type of bottom and remarks
39	9– 8–49	148	Mud
40	9– 8–49	10	Gravel, mud (alongshore)
41	10– 6–49	295	Rocks, stone, gravel (*Psolus*)
42	10– 6–49	216	Rocks, stones (*Psolus* and sea urchins)
43	10– 6–49	213	Gravel, mud
44	10–11–49	453	Rocks, stones, gravel (small amount) (*Psolus*)
45	10–11–49	341	Rocks (few), stones, gravel (sea urchins)
46	10–14–49	152	Stones, mud, rocks (few)
47	10–14–49	175	Gravel, stones (small) (sea urchins)
48	2–13–50	129. 5	Mud (bottom sampler)
49	2–14–50	149	Mud, stones (small) (haul made by dog team)
50	2–18–50	162	Mud, gravel, stones, rocks (few small) (haul made by dog team)
51	3– 9–50	135	Mud (very sticky) (haul made by dog team)
52	3–18–50	185	Mud, gravel, stones (bottom sampler)
53	3–21–50	120–130	Mud (Small bottom sampler)
53a	4–11–50	170	Mud (bottom sampler) (off radio mast)
53b	4–11–50	175	Mud (bottom sampler) (off Browerville)
54	7–21–50	72	Mud
55	7–22–50	132	Mud, gravel, shell, stones
55a	7–22–50	134	Mud, gravel, shell, stones
56	7–22–50	141	Mud, gravel, shell, stones
57	8– 1–50	118	Mud, gravel, shell, stones
58	8– 1–50	122	Mud, gravel, shell, stones
59	8– 1–50	138	Mud, gravel, sand, shell, stones (few small)
60	8– 1–50	40	Mud, stones (Eluitkak Pass)
61	8– 5–50	204	Mud, stones, gravel
62	8– 5–50	151	Mud, gravel

and to the surging currents that sweep through the Pass, stirring up the mud.

During the winter of 1949–1950, sampling and dredging were carried on through the ice, the dredging powered by means of dog teams. (For details of methods, see G. E. MacGinitie, 1955, pp. 53–57.) The results obtained were somewhat disappointing in that storms in early autumn had desposited several inches of mud over the ocean floor out for a distance of an undetermined number of miles—farther than the solid ice extended, so that it was impossible to dredge in a rubble zone that had not been blanketed with mud (see stations 48–62 in table 1). Some of the mud-dwelling pelecypods transported to the rubble zone by the storms were able to become established in this blanket of mud.

Trapping stations, not included in the following table, were maintained throughout the winter. At depths of 7, 21, 37, 64, and 80 feet, holes through the ice were kept open and screen and wire-mesh traps, usually baited, were kept on the ocean floor and inspected at intervals. All of these trapping stations were on muddy bottom, with the 80-foot hole at a distance of 1.8 miles from shore.

The Present Study

The writer undertook the identification of the mollusks from Point Barrow unaware of the great amount of work and complex difficulties involved. The work was scarcely begun before it became evident that the identifications would be far from simple and that library research would be extremely important. The difficulties of identification are due partly to the extreme variability of the Arctic shells, which has resulted in descriptions of numerous forms and varieties as separate species. But perhaps the greatest difficulty derives from the fact that in all too many instances taxonomists working on western specimens described as new species ones that had previously been described from Europe or Greenland, perhaps assuming that Greenland and the islands north of eastern Canada form an effective geographical barrier in a roughly circular ocean and that the distance in the other direction is too great for migration. Within recent years almost no one in America has worked on Arctic mollusks and the early names have been passed along in the literature without rechecking. Distribution records will be changed considerably when specimens in various collections can be reexamined and when more detailed study can be made at the family or generic level.

Two other factors contributed toward making the work time consuming: the inaccessibility of comparative material and of literature.

1. With the exception of that of the U. S. National Museum, the collections examined by the writer have almost no shells from Arctic waters; and the collection in the U. S. National Museum has relatively few specimens from the European Arctic or even from the Canadian Arctic. (The writer would like to stress the need for an exchange of northern specimens between institutions in this country and European institutions. An exchange of specimens among institutions, not only between different countries but also between institutions within this country, would materially decrease the labors of future workers and, in the event of major disasters, would be good insurance against total loss of specimens of certain species. A picture may be worth a thousand words, but often the best of illustrations cannot convey the ideas that a single specimen would impart.)

2. In order to straighten out some of the taxonomic problems in which many of the species were involved, it was necessary to consult the original descriptions. An attempt was made to read all of the original descriptions but it was not always possible to do so. In several instances the original description is in a copy of a journal or publication available in this country only in the Library of Congress or perhaps one other institution in the East.

Establishing the exact date of publication was almost impossible in certain references. In the belief that the reader will be interested in the reason for changes in date or author, explanations for such changes have been included in the text or in footnotes and in some instances explanatory notes have been added in the bibliography. It is hoped that such explanations will save future workers hours of library research.

In a work such as the present paper, it would be impossible to give complete synonymies for all the species, for in many instances the complete synonymy covers several pages. For example, one species dealt with in this paper has been known under 12 generic and 15 specific names, with many combinations of these various generic and specific names. The objective, therefore, has been to include the reference for the original description and, if possible, a recent and accessible American publication [2] that contains an illustration, as well as one of the more recent European publications that contains an illustration. In addition, references in the synonymies may include some of the less well-known synonyms, those containing good discussions or good distribution records, and references to those species placed in synonymy by the present writer.

Perhaps nowhere in the world do shells consistently exhibit such marked and confusing variations as do the Arctic species. Among the gastropods the genera *Buccinum*, *Boreotrophon*, *Neptunea*, *Beringius*, and *Diaphana* and among the pelecypods *Musculus*, *Astarte*, and *Liocyma* are particularly subject to variation. Because of these great variations, species of some of these genera are extremely difficult to identify and in order to resolve these problems it will be necessary to make intensive studies at the specific level.

The Leptonidae in this country need a complete revision, for many species have not been assigned to the proper genus. A lifetime of work would be inadequate to bring complete order to the taxonomic chaos existing in the Turridae of this country, and the Pyramidellidae and Rissoidae are likewise in need of intensive work. At present the situation in these families is such that in many instances it is impossible to assign a species to a genus. Consequently several species have been referred to *"Oenopota"* in this paper.

In many instances the existing knowledge of a species is insufficient to enable one to say whether a specimen represents a variety or merely a form of the species. And in very few instances is existing information sufficient to enable one to refer a specimen to a subspecies in the present explicit meaning of the term.

The present paper is merely a beginning and no one realizes better than the writer that there are many unresolved problems, but it is hoped that it will point out the need for further study—and it is consoling to know that even the mistakes will contribute toward that goal.

In order to save space, collection dates usually have been omitted and are included only when they have some special significance, such as in the listing of young stages or of mature eggs or in those instances

[2] In recognition of the value of good illustrations, references to popular and semipopular works have been made freely.

in which there are duplicate depths. In the table on dredging stations the reader may find the collection date opposite the depth.

Complete ecologic and natural history notes are difficult to make on a large number of species before positive identifications are available. Such notes as are available are included under the appropriate genera or species in the systematic section below. Egg capsules of the gastropods were turned over to Dr. Gunnar Thorson of Copenhagen for study and the results of his work are now ready for publication.

The Molluscan Fauna of Point Barrow

Table 2 summarizes the geographic distribution of the Point Barrow mollusks, as well as their distribution in depth at Point Barrow. It should be understood that both of these are subject to change pending reexamination of collections and more extensive dredging at Point Barrow.

Among the prosobranchs of the gastropods there are 20 families, comprising at least 35 genera and 70 species, plus at least 10 varieties. Ten of these families are represented by only one species. The largest families are the Turridae, with 5 or more genera and 13 species, and the Neptuneidae, with 6 genera and 11 species. The Lamellariidae and Trochidae are next, each with 3 genera and 11 species. The genus *Buccinum*, with 8 species, is by far the largest genus, the next largest being *Boreotrophon* with 4 species and *Trichotropis* with 3 species.

The identification of the Opisthobranchiata is still incomplete but this group is being studied by Dr. H. Lemche of Copenhagen. When his work is completed, several more eolids and dorids should be added to the above list.

At this point mention should no doubt be made of the mollusks taken through the ice in winter. Dredging stations 49–51 were outside the pressure ridge or point where the ice was grounded. One of the 5 living specimens of *Admete couthouyi* was taken at 162 feet, 2 of the 7 living *Oenopota harpa* were dredged at 149 and 162 feet, and 1 of the 5 living *Beringius stimpsoni* was dredged at 162 feet. One of the 2 living *Cylichna occulta* was taken through the ice at a depth of 33 feet.

It is of especial interest that more than half the living *Buccinum angulosum* collected were taken by traps: 1 of the 5 typical *B. angulosum* (at 64 feet), 12 of the 18 var. *normale* (at 37 feet), 13 of the 26 var. *subcostatum* (at 37 and 64 feet), and 13 of the 14 var. *transliratum* (at 37, 64, and 80 feet). Several other species of *Buccinum* were also taken with traps: 5 of 9 *B. polare* (at 64 and 80 feet), 2 of 10 *B. tenue* (at 64 and 80 feet), 1 of 40 *B. plectrum* (at 37 feet), and 1 of 50 *B. glaciale* (at 80 feet).

The two chitons were both fairly common and, with the exception of Eluitkak Pass, were taken at most stations that afforded suitable places for attachment.

The cephalopods are of interest in that both the squid (*Gonatus*) and the *Benthoctopus* are new to the Arctic and the *Cirroteuthis* is undoubtedly a new species.

The pelecypods are represented by 16 families,[3] comprising 25 genera and 37 species, plus several varieties. The family Nuculanidae is represented by 2 genera with 6 species, the Mytilidae and Tellinidae each by 2 genera and 4 species, the Leptonidae by 3 genera and 3 species, and the Hiatellidae by 2 genera and 3 species. Five families are represented by only one species.

The collection contained 3 new species that have been described, plus 1 new name, and undoubtedly 4 new species that are still undescribed. One of the latter is the deep sea octopus and the other three belong to the Turridae, a family that is being worked on by a retired malacologist.

Of the 107 species and 11 varieties (exclusive of the new species) listed in the above table, 59 species and 7 varieties are new to Point Barrow, and of this number 36 species and 7 varieties are new to Arctic Alaska and 18 species and 4 varieties are new to Arctic America. Exclusive of the new species, only 4 are new to North America.

A total of 17 species (including the new ones) and 4 varieties have been reported only from the Arctic area of the eastern Pacific, 12 species and 1 variety only from the Arctic area of the western Atlantic. Only 4 species, typical *Buccinum angulosum*, *Margaritopsis*? *grosvenori*, *Raphitoma amoena*?, and *Nuculana arctica*, and 2 varieties, *B. angulosum* var. *normale* and var. *subcostatum*, have been reported only from the Arctic. The fact that fewer species have been reported only from the Arctic on the east coast of North America than on the west coast may be the result of more collecting on the east coast.

One could make a summary of the number of species taken from the various depths but it would have little value. Aside from the factor of a suitable substratum, the number of species taken at the various depths outlined above reflects fairly well the amount of dredging that was done. The depths between 110 and 184 feet yielded more species than any of the others, but these depths represent 29 dredging stations, whereas the depths between 204 and 295 feet represent only 5 stations, the depths of 328 and 341 feet only 2 stations, and those between 420 and 477 feet only 4 stations.

[3] Nicol's (1955) analysis of the MacGinitie collection of pelecypods from Point Barrow was based on an incomplete and incompletely identified collection. The collection contains 4 families, 7 genera, and 8 species in addition to those listed by Nicol. The number of individuals in the genera listed was also based on an incomplete collection. The collection was made by G. E. MacGinitie, not by Mrs. MacGinitie as stated in the paper.

TABLE 2.—*The mollusks of Point Barrow, Alaska*

KEY TO SYMBOLS: (1) Species has been taken only in Arctic area of Pacific; (2) species has been taken only in Arctic area of Atlantic; (3) species or variety not included in list of mollusks from west coast of North America; (4) species or variety included under another name; (5) new species; (6) new name; (7) other than in the Arctic, species taken only in Iceland; (8) species or variety new to North America; (d) dead specimen (listed only for the rarer species); (I) species trapped or dredged in winter through the ice; (P) plankton; (U) underground, near shore.

Order and Family	Genus	Species	Eastern Pacific	Western Pacific	Eastern Atlantic	Western Atlantic	Greenland	Spitzbergen	Aleutians	New to Point Barrow	New to Arctic Alaska	New to Arctic America	Washed ashore	Elliktkak Pass (40 ft.)	10 ft.	33–80 ft.	110–184 ft.	204–295 ft.	328–341 ft.	420–477 ft.	522 ft.	741 ft.
GASTROPODA																						
Aspidobranchia																						
Lepetidae	Lepeta	caeca[3]	X		X	X	X	X	X	X	X						X			X		
Puncturellidae	Puncturella	noachina[3]	X		X	X	X	X		X	X						X			X		
Trochidae	Margarites	costalis var. grandis[3]	?	?				?		X	X						X					
		avenosooki[3]	X[1]																			X
		frigidus	X[1]		X		X	X		X	X						X			X		X
		vahli[3]	X[1]														X	d		X		X
	Margaritopsis	pribiloffensis	X[1]				X[2]										X	X	X	X		
		grosvenori[3]	X	X		X			X	X	X	X										
	Solariella	obscura	X														X	X		X		X
	Molleria	costulata[3]	X[1]																			
Ctenobranchia																						
Epitoniidae	Epitonium	greenlandicum	X		X	X	X	X	X		?						X	X	X	X		
Lacunidae	Aquilonaria	turneri	X[1]			X	X	X		X	X						X	X	X	X		
Rissoidae	Cingula	castanea[3]	X[1]		X	X	X	X		X	X						X	X	X	X		
	Alvania	jan-mayeni ?[4]	X[1]		X[2]	X	X	X	X	X	X	X					X	X		X		
Turritellidae	Tachyrhynchus	reticulatum	X			X	X			X	X						X	X		X		
Triphoridae	Triphora	perversa[3]	X[1]		X	X	X			X	X						X	X	X	X		
Crepidulidae	Crepidula	grandis	X	X		X	?		?	X							X	X		X		
Trichotropidae	Trichotropis	bicarinata	X	X		X	X	X	X	X							X	X		X		
		borealis	X	X	X[2]	X	X	X	X	X							X	X	X	X		X
		kroyeri	X	X	X	X	X	X	X	X							X	X	X	X		X
Naticidae	Natica	clausa	X	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X
	Polinices	pallidus	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X
		monteronus	X										X				X	X		X	X	X
Lamellariidae	Onchidiopsis	glacialis[3, 5]	X[1]		X[7]		X	X					X									
		groenlandica			X		X	X	X				X									
		var. pacifica	X	X																		
	Pilliscus	commodus	X	X		X											X	X	X	X		

Velutina
undata[4]
velutina[4]
plicatilis[4]
lanigera[3, 8]
Muricidae
Boreotrophon
clathratus[3]
beringi
pacificus
truncatus[3]
glaciale
var. morchianum
plectrum
tenue
polare
angulosum
var. normale
var. subcostatum
var. transliratum
fringillum
ciliatum
undatum
Buccinidae
Buccinum
var. striatum[3]
deformis
stefanssoni
stimpsoni
beringi[3]
var. kobelti
kroyeri
spitzbergensis
capponius
martensi
ventricosa
heros[4]
middendorffiana[6]
occidentalis
couthouyi
regina
tenuilirata
sp. 1
sp. 2
simplex[4]
sp. 3
nazanensis
tenuicostata
harpa
elegans
harpularia
pyramidalis[3]
impressa
amoena ?[3]
Neptuneidae
Pyrulofusus
Volutopsius
Beringius
Plicifusus
Colus
Neptunea
Fusinidae
Ptychatractus
Cancellariidae
Admete
Turridae
Obesotoma
Oenopota
"Oenopota"
Nodotoma
Raphitoma

TABLE 2.—*The molluscs of Point Barrow, Alaska*—Continued

Order and Family	Genus	Species	Eastern Pacific	Western Pacific	Eastern Atlantic	Western Atlantic	Greenland	Spitzbergen	Aleutians	New to Point Barrow	New to Arctic Alaska	New to Arctic America	Washed ashore	Elliktkak Pass (40 ft.)	10 ft.	33–80 ft.	110–184 ft.	204–295 ft.	328–341 ft.	420–477 ft.	522 ft.	741 ft.
Opisthobranchiata																						
Acteocinidae	Retusa	umbillicata	X		X	X	X	X	X	X	X				X	1						
Scaphandridae	Cylichna	occulta	X		X	X	X	X		X	X					X					X	
Diaphanidae	Diaphana	minuta [4]	X		X	X	X	X								X	X	X			X	X
Pyramidellidae	Odostomia	cassandra	X							X	X	X			X		X	X		X		
Doridae	Aldisa	zetlandica [2 3]	X		X	X				X	X											
Dendronotidae	Dendronotus	frondosus [2 3]	X	X	X		X	X		X	X		X		X		X					
		sp.	X	X													X					
Flabellinidae	Coryphella	salmonacea [2]	X		X	X	X	X		X	X		X	?			X	X	X	X	X	X
Spiratellidae	Spiratella	helicina [4 7]	X		X	X	X	X	?	X	X			P			X	X	X	X	X	X
Clionidae	Clione	limacina	X		X		?		X	X	X			P			X	X	X	X	X	X
AMPHINEURA																						
Chitonida																						
Lepidochitonidae	Trachydermon	albus	X		X	X			X							X	X	X	X	X	X	X
Cryptochitonidae	Symmetrogephyrus	vestitus	X		X	X	X	X								X	X	X	X	X	X	X
CEPHALOPODA																						
Decapoda																						
Gonatidae	Gonatus	fabricii	X		X	X	X	X						X								
Octopoda																						
Cirroteuthidae	Cirroteuthis	sp. [5 7]	X															X				
Octopodidae	Benthoctopus	hokkaidensis [3]	X	X						X	X	X										
PELECYPODA																						
Prionodesmacea																						
Nuculidae	Nucula	tenuis	X		X	X	X	X	X	X	X					X	X	X		X		X
Nuculanidae	Nuculana	minuta	X	X	X	X	X	X								X	X	X		X	X	X
		radiata	X	X	X	X [3]	X	X	X	X						X						
	Yoldia	arctica	X				X	X	X		X					X						
		myalis	X	X		X	X	X	X							X	X	X	X	X		
		hyperborea [8]	X	X	X	X	X	X	X				d			X	X			X		
		scissurata	X	X	X	X	X	X	X				d			X	d					
Pectinidae	Chlamys	islandica	X	X	X	X	X	X	X	X	X						X	X		X	X	X

| | | |

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Class Gastropoda

Subclass Streptoneura

Order Aspidobranchia

Suborder Docoglossa

Family Lepetidae

Genus Lepeta Gray, 1847

***Lepeta caeca* (Müller, 1776)**

Plate 4, figures 1, 1a

Patella caeca Müller, 1776, p. 237.
Lepeta caeca Jeffreys, 1865b, p. 252, pl. 5, fig. 6.—G. Sars, 1878, p. 123, pl. 20, figs. 17a, b.—Morris, 1947, p. 73, pl. 25, fig. 2; 1951, p. 106, pl. 25, fig. 2.
Lepeta alba Dall, 1870a, p. 145, pl. 15, figs. 3a–d.
?*Lepeta alba instabilis* Dall, 1870a, p. 145, pl. 15, fig. 6.
Lepeta coeca Odhner, 1912, pp. 12, 32, pl. 2, figs. 2–17.

Thirty-four specimens, eight of which were dead shells, were dredged from depths ranging between 125 and 477 feet, the majority coming from 217 feet (10 living specimens) and deeper. The shells range in length from 5.5 to 11.0 mm. The measurements of several shells are as follows: 10.3 long by 7.8 wide by 4.8 mm. high; 10.1 by 7.8 by 4.5 mm.; 10.0 by 7.6 by 4.8 mm.; 9.1 by 7.1 by 4.1 mm.; and 8.8 by 6.6 by 3.8 mm.

Other material examined: Seventy specimens from Norway, Greenland, Labrador, Newfoundland, Green Bank in the Bay of Fundy, Frenchman's Bay, Maine, near Cape Gaspé, and the east end of Cabourg Island in Baffin Bay. About 25 specimens (all dead shells) from localities ranging from the Sea Horse Islands, Alaska, to Captain's Harbor in the Aleutians (lat. 55° N.).

Discussion: These specimens correspond with those collected at Point Barrow. Three specimens from western Norway are a trifle flatter and in one the apex is somewhat nearer the center than usual, but these variations are within normal limits.

There has been a great deal of confusion regarding the northern species of *Lepeta*. In *L. caeca* the posterior slope is nearly always markedly convex, and the anterior slope is straight (pl. 4, fig. 1a) and never slightly concave as in *L. concentrica* and *L. caecoides*. The radiating lines of striae in *L. caeca* are granular, the granulation varying in coarseness. *L. caeca* is relatively higher than *L. concentrica* and *L. caecoides*. For example, a specimen of *L. caecoides* measuring 10.4 mm. long by 8.0 wide is 3.3 mm. high, and a specimen of *L. caeca*

measuring 10.1 mm. long by 7.8 wide is 4.5 mm. high. Practically all of the *Lepeta* under *L. concentrica* and *L. caecoides* from the Sea Horse Islands, Icy Cape, Plover Bay, and Indian Point are actually *L. caeca*, and the others are too worn to be assigned to any species with certainty.

Dall's type lot of *Lepeta alba*, 13 specimens from Plover Bay, are undoubtedly *L. caeca*; they are all worn shells in much too poor a condition to base a description of a new species. Other specimens under *L. alba* are so worn that identification cannot be certain; from the shape, some appear to be *L. caeca*, others may be *L. caecoides*, and perhaps some are *L. concentrica*, but without the apex and with all the sculpture worn away they cannot be identified. The types and cotypes of *L. alba instabilis* are all dead shells and so eroded that a description should not be based upon them.

DISTRIBUTION: *Lepeta caeca* has been reported from Jan-Mayen, Spitzbergen, Norway, Iceland, Greenland, and from the Canadian Archipelago to Newfoundland and Cape Cod (Thorson, 1944). It has been taken from Point Barrow west and south to Captain's Harbor in the Aleutians. The Alaskan localities are new.

Suborder RHIPIDOGLOSSA

Family FISSURELLIDAE

Genus *Puncturella* Lowe, 1827

Puncturella noachina (Linnaeus, 1771)

PLATE 2, FIGURE 5; PLATE 4, FIGURES 2, 7

Patella noachina Linnaeus, 1771, appendix, p. 551.
Puncturella noachina Jeffreys, 1865b, p. 257, pl. 6, fig. 2.—Odhner, 1912, pp. 13, 37, pl. 2, figs. 28–41.—Farfante, 1947, p. 138, pl. 60, figs. 1–3.

One living specimen of this species was collected at a depth of 184 feet. The shell is 6.5 mm. long by 4.9 wide by 3.3 high.

OTHER MATERIAL EXAMINED: Numerous specimens from the western Atlantic. About 17 specimens collected by Dall in Captain's Bay, Unalaska, the Chica Islands, and the Shumagins; about 86 specimens collected by W. J. Fisher at Kodiak Island; 1 specimen from Stephens Passage (near Juneau).

DISCUSSION: Farfante (1947) states that this species has been recorded from southern Indian Ocean, from the Sea of Okhotsk, from Korea, and from Japan, and suggests that these latter records should "be restudied to determine if they are *Puncturella noachina* or a closely allied species." I examined a lot of 20 *Puncturella* (USNM 227297) from Hakodate, Japan. These are not *P. noachina*. They have a longer aperture, a wider and less funnel-shaped septum; they lack

the props and the triangular depressions at the sides of the septum (see pl. 4, fig. 2); they lack the calloused ridges, the groove is less pronounced, and there are no rows of chalky-white marks.

DISTRIBUTION: In the eastern Atlantic from Franz Josef Land, in the Arctic Ocean south to Scotland and northern England and on the continent along the coast of Norway south to Spain. In the western Atlantic from Greenland and the Melville Peninsula, and from Hudson Bay south to Cape Cod (Farfante, 1947). Magellan Strait, Patagonia, and the Falkland Islands (Odhner, 1912).[4] In the eastern Pacific from Point Barrow, the Aleutians, the Shumagins, and south of Juneau. This species is new to Arctic Alaska.

Family TROCHIDAE

Genus *Margarites* Gray, 1847

Margarites costalis (Gould, 1841, ex Lovén MS)

VARIETIES

PLATE 1, FIGURES 1–7

Margarita striata Broderip and Sowerby (not Leach, 1819), 1829, p. 371.
Turbo cinereus Couthouy (not Born, 1778), 1838, p. 99, pl. 3, fig. 9.
Margarita cinerea Gould, 1841, p. 252.—Odhner, 1912, pp. 17, 62, pl. 4, figs. 28–37; pl. 5, figs. 1–5.
Trochus costalis Gould (ex Lovén MS), 1841, p. 252.
Turbo corneus Kiener (not Linnaeus, 1758), 1847–1848, pl. 19, fig. 2 [text in 1873, by P. Fischer, vol. 22, p. 129].
Margarita sordida Hancock, 1846, p. 324 [as substitute for *M. striata* Broderip and Sowerby].
Margarita cinerea var. *grandis* Mörch, 1869, p. 19.—Odhner, 1912, p. 17, pl. 4, figs. 34–36.
Margarita cinerea var. *grandis* forma *multilirata* Odhner,[5] 1912, pp. 65–67, pl. 4, fig. 33; pl. 5, figs. 1, 2.
Margarites sordida Dall, 1921, p. 178, pl. 17, figs. 11, 12.
Margarites costalis Rehder, 1937, p. 115.
Margarites cinerea Morris, 1951, p. 114, pl. 26, fig. 5.

At least 100 specimens—the majority of which were living—of varieties of this species were taken from 16 stations at depths ranging

[4] In a personal communication Dr. Odhner informs me that he made no personal examination of specimens from these regions but that they were reported by Strebel in 1907 and 1908 and that his specimens are stored in the Riksmuseum. The division of mollusks of the U. S. National Museum sent me for examination several specimens from the above regions that had been described under the names of *Rimula corica* d'Orbigny and *Puncturella falklandica* A. Adams and later had been assigned to *P. noachina* by one conchologist. The type of *R. corica*, from Cape Horn, and another specimen from the west coast of Patagonia are definitely not *P. noachina*.. *R. corica* has a different apex, the shell is higher and thinner and the apical slit is widest at a different point; there are no props and the calloused ridges are lacking. *P. falklandica* bears more resemblance to *P. noachina*, but in at least five specimens from western Patagonia the props are lacking and the septum is shorter than in *P. noachina*. Further study will be necessary to determine whether or not a few specimens from Magellan Strait actually are *P. noachina*.

[5] Odhner (1912) generously ascribes forma *multilirata* to Mörch (1869), but Mörch did not use "multilirata" as the name of a form, he merely used the word in describing some of the variations of the var. *grandis*. Consequently, the word had no standing as forma *multilirata* until Odhner described and illustrated it in 1912.

from 120 to 741 feet. The stations at 217, 341, 420, and 453 feet yielded 14, 31, 17, and 26, respectively. About 10 of the specimens from 341 feet range in size from 7.7 mm. high by 8.6 mm. in diameter to 10.2 by 11.8 mm.; the others range from the latter size up to 20 mm. in height. Two specimens from 477 feet measure 5.7 mm. high by 6.5 mm. in diameter and 10 mm. by 10.3 mm. Two from 453 feet are 20.4 by 19.7 mm. and 17.9 by 18.3 mm.; one from 184 feet is 20.4 by 18.8 mm., and one from 120 feet (Aug. 8, 1949) is 20.8 by 18.5 mm. The younger specimens are broader than high and the larger ones are higher than broad.

Other material examined: Varieties of *M. costalis* from the mouth of the Mackenzie River, Peard Bay and vicinity, and "north of Bering Strait"; numerous specimens from Melville Island, Greenland, Labrador and Newfoundland listed under various names; and specimens of typical *M. costalis* from south of Bering Strait and from Greenland and Norway.

Discussion: Typical specimens of *M. costalis* are characterized by 4 to 6 prominent spiral ridges or cords that lend an angular appearance to the whorls, they are angled at the periphery of the last whorl and the base is flattened; the axial folds or ribs of the apical whorls give the latter a nodulus appearance, and the spiral ridges are alternated with secondary threads or lirae. The Point Barrow specimens are not typical *M. costalis;* they belong rather to the variety *grandis* Mörch (pl. 1, fig. 1) and the larger forma *multilirata* Odhner (pl. 1, figs. 5, 7). In both of these forms the spiral ridges are more numerous, from 5 to 8; they are often uniformly spaced without alternating smaller spiral lirae and, when present, the alternating lirae are not very pronounced and number only from 1 to 4, perhaps 5, on the last whorl. The shell is not angled at the periphery of the last whorl and the base is rounded. In var. *grandis* the base may be without any spiral lirae, or there may be from 1 to 6, with perhaps 2 to 3 around the strong cord outlining the umbilicus and 2 or 3 more near the margin (pl. 1, fig. 2). In forma *multilirata,* the base may have from 6 to 12 spiral lirae or cords (pl. 1, fig. 7), all of which may be uniformly strong, or uniformly weak, or may vary in strength in the same shell. The number of basal lirae seems to have little or no relation to the size of the shell. In both var. *grandis* and forma *multilirata* the nodulous appearance of the apical whorls is much less pronounced than in typical *M. costalis.* In some specimens from Melville Island the cord outlining the umbilicus is very weak, and in some the incremental lines are crowded into raised groups at intervals, detracting from the silky appearance characteristic of shells of this species. In the Point Barrow specimens and in the other specimens examined from other northern localities, there

are all types of combinations of characters and all transitional forms of sculpture.

DISTRIBUTION: The variety *grandis* and forma *multilirata* are circumpolar. They have been reported from Greenland to the Gulf of St. Lawrence, and from the European Arctic. They have not been reported previously from Arctic Alaska.

Margarites avenosooki, new species

PLATE 1, FIGURE 8; PLATE 3, FIGURES 8, 9

Shell medium sized, somewhat depressed, with 5½ rapidly expanding whorls, including about 1½ nuclear whorls. External surface of shell a rosy, grayish white, becoming ashy on the spire and within the umbilicus. Interior of aperture pearly, with brilliant greenish and pinkish lines of light, the green bands in shallow grooves corresponding to the spiral cords and threads on the external surface and the pinkish bands to the interspaces. Widely umbilicate whorls visible within to the nucleus. Sculpture of about 8 primary spiral cords on last whorl, with from 1 to 2 secondary threads between the cords near the suture but only one between those near the base; about 7 cords on the penultimate whorl, with secondary threads between most of them; about 5 cords on the antepenultimate whorl, with no secondary threads between them; about 7 equally spaced steplike cords on the slightly convex ascending base; 3 smaller cords on the descending slope of the base at the beginning of the umbilicus; remainder of the funnellike umbilicus devoid of cords; 5 cords visible on the body whorl between the inner and outer lip of the aperture. Spiral cords crossed by silky incremental lines, resulting in an uneven wavy appearance and, in some places, especially on those cords nearest the sutures, in a slight beaded effect. Aperture large, subquadrately oblique. Lip thin and crenated by the spiral cords. Operculum thin, multispiral, straw-colored.

DIMENSIONS: Holotype: height, 8.9 mm.; diameter, 11.7 mm.; angle of spire, 96°.

TYPE LOCALITY: About 4 miles off Point Barrow base, Alaska. Depth, 217 feet. Bottom: stones, large perforated rocks. Collected by G. E. MacGinitie, Sept. 6, 1949.

REPOSITORIES: Holotype, U. S. National Museum, No. 606,374; paratype, No. 606,375 (diameter, 2.8 mm., from 341 feet). One paratype (height, 9.2 mm.; diameter, 11.3 mm., from 420 feet), Stanford Univ. Paleo., No. 8331.

OTHER LOCALITIES: Bering Sea (1 dead), Bering Strait (1 live, 2 dead), north of Bering Strait (1 live), collected by U. S. S. *Corwin;* Plover Bay (2 live), St. Lawrence Bay (1 live). All these specimens

are in the collection of the U. S. National Museum. Depths, when specified, from 10 to 30 fms.

REMARKS: The outer lip of the holotype is somewhat broken. Some specimens are entirely grayish white or ashen without any rosy tint but aside from this and the variability of the intercalary threads and the piling up of incremental lines into incipient axial sculpture, there is little variation in the specimens examined. This species is named in honor of Mr. Olaf Avenosook, an Eskimo who served G. E. MacGinitie as boatman during the summer of 1948.

Margarites frigidus Dall, 1919

PLATE 2, FIGURE 7; PLATE 3, FIGURE 7

Margarites frigidus Dall, 1919b, vol. 56, p. 357.

This species was dredged from depths of 120 to 741 feet. Fourteen individuals (mostly from 1.6 to 2.5 mm. in height, but a few up to 6.5 mm.) came from 741 feet; 21 (mostly from 1.7 to 2.3 mm., but up to 6.0 mm.) came from 477 feet; 4 (from 1.5 to 2.4 mm.) came from 453 feet; and 9 (ranging from 3.0 to 7.0 mm. in height) were found among foliaceous bryozoans at a depth of 120 feet on Sept. 15, 1948. The largest specimen, 7.0 mm. in height, came from 130 feet on Aug. 9, 1949. One or two specimens were found in hauls from other depths, but the majority were very small.

The ovaries of several of the larger specimens of *M. frigidus* taken from 741 feet were filled with large eggs (larger than those of *M. vahli*) encased in thick membranes. These large eggs indicate that the larvae of *M. frigidus* must hatch in the crawling stage, and it is even possible that the eggs are retained until they hatch.

OTHER MATERIAL EXAMINED: About 17 specimens, including the type, from Bering Strait and the Arctic Ocean.

DISCUSSION: In some specimens the umbilicus is entirely closed and in others it is a mere slit. The young of *M. frigidus* have a more open umbilicus than larger specimens and hence may be difficult to distinguish from the young of *M. vahli* of similar size. The similarity is especially marked if they are in alcohol or other fluid, for then the delicate, incised lines on the base near the umbilicus of *M. frigidus* are often invisible. However, if the shells are allowed to dry, *M. vahli* remains as glossy as ever and *M. frigidus* becomes duller, with a silky rather than a glossy surface.

DISTRIBUTION: The range of *M. frigidus* is from approximately long. 134° to 170° W. and lat. 57° to 71° N., or from the Admiralty Islands (near Juneau), Alaska, to Nunivak Island, Bering Sea, and north and east to Point Barrow. The latter is a new locality. In

several publications the type locality of *M. frigidus* is given as "north of Bering Strait." The type specimen is from the north end of Nunivak Island, which is 5° south of Bering Strait.

***Margarites vahli* (Möller 1842)**

PLATE 4, FIGURES 8, 9

Margarita vahlii Möller, 1842a, p. 8; 1842b, p. 81.—Odhner, 1912, pp. 17, 67, pl. 3, figs. 35–40; pl. 6, figs. 6–7.

Approximately 25 specimens of this species were collected from depths ranging from 120 to 741 feet. The largest specimens (3.4 high by 3.8 mm. wide, and 4.3 by 4.7 mm.) came from 741 feet. The next largest (3.2 by 3.4 mm.) came from 477 feet and another of the same height came from 453 feet. The remaining specimens were small: 2 (1.5 by 1.8 mm.) from 420 feet; 1 (1.5 mm. high) from 453 feet; 5 (from 1.5 to 3.2 mm. high) from 175 feet; and 5 (from 1.8 to 2.8 mm. high) were found among a foliaceous bryozoan at 120 feet on Sept. 15, 1949.

The ovaries of two specimens (4.3 mm. and 3.0 mm. high, respectively) from 741 feet were well filled with large eggs. Judging from the large size of its eggs, it is probable that this species has a short pelagic larval development.

OTHER MATERIAL EXAMINED: Five specimens from Spitzbergen and eight from Greenland.

DISTRIBUTION: Parry Islands, Labrador, Greenland, Iceland, and Spitzbergen (Thorson, 1944). The discovery of this species at Point Barrow materially extends its range westward. It is new to Arctic Alaska.

Genus *Margaritopsis* Thiele, 1906

***Margaritopsis pribiloffensis* (Dall, 1919)**

PLATE 2, FIGURE 10; PLATE 8, FIGURE 1

Margarites pribiloffensis Dall, 1919b, p. 366.

Three living specimens and two worn shells were collected. The 2 shells (5.7 and 5.2 mm. wide, respectively) and 1 living individual (7.5 high by 7.4 mm. wide) came from 741 feet, and 1 living juvenile about 1.0 mm. wide and another about 3.6 mm. wide came from 477 feet. Both of these stations were characterized by muddy bottoms and masses of terebellid worm tubes.

OTHER MATERIAL EXAMINED: The type, from near the Pribilof Islands; one specimen from near Point Belcher, and another from Bernard Harbor, Northwest Territories.

DISTRIBUTION: As above. Point Barrow is a new locality.

Margaritopsis ? grosvenori (Dall, 1926)

PLATE 2, FIGURE 12; PLATE 4, FIGURES 4, 5; PLATE 8, FIGURE 2

Margarites grosvenori Dall, 1926, p. 59.

One live specimen (3.1 mm. in diameter) was taken at 152 feet, 1 dead shell (3.5 high by 3.6 mm. in diameter) at 175 feet, and a broken shell at 216 feet.

OTHER MATERIAL EXAMINED: The types, consisting of 2 large broken shells from northwest Greenland, 1 medium specimen from Ungsuak, Greenland, and 4 large ones and 1 juvenile from Cabourg Island, Baffin Bay.

DISCUSSION: The specimens from northwest Greenland have finer striae than the ones from Point Barrow (pl. 8, fig. 2), and the ones from Cabourg Island have still finer spiral striae, but the specimen from Ungsuak has striae as coarse as those from Point Barrow.

In his original description Dall speaks of "the inner lip nearly covering a narrow umbilical opening." Actually, the umbilical opening in the types is at least moderately open and although the inner lip does overhang the opening to a certain extent, it is so high above the opening that the "covering" effect is not pronounced (pl. 4, fig. 5). This characteristic applies to all the specimens I have seen. The Point Barrow specimens are limy in appearance rather than "translucent pearly white," but this is a common variation in Point Barrow shells, especially in dead specimens.

This species was described as a *Margarites* but, because it has spiral sculpture and lacks axial sculpture and is without a spiral cord outlining the umbilicus, I have, with reservations, placed it in *Margaritopsis*. The peritreme is entire.

DISTRIBUTION: The Point Barrow specimens extend the range of this species from Greenland and Baffin Bay westward to Arctic Alaska and the Pacific area of the Arctic.

Genus *Solariella* Wood, 1842

Solariella obscura (Couthouy, 1838)

PLATE 1, FIGURE 9; PLATE 2, FIGURE 11

Turbo obscurus Couthouy, 1838, p. 100, pl. 3, fig. 12.
Solariella obscura Odhner, 1912, pp. 18, 70, pl. 5, fig. 22; pl. 7, figs. 9–20.—Dall, 1921, p. 178, pl. 18, figs. 11, 12.—Abbott, 1954, p. 110, figs. 31f–g.

One living adult and 5 young and juvenile specimens were collected: 1 (6.6 high by 7.6 mm. wide) at 132 feet, 4 juveniles at 216 feet, and 1 young (2.4 mm. wide) at 453 feet.

OTHER MATERIAL EXAMINED: About 175 specimens from Labrador to Massachusetts and Rhode Island, over 30 specimens from the eastern Atlantic (Russia, Norway, and other localities, and 7 speci-

mens from the eastern Pacific (from Icy Cape through Bering Strait to the Pribilofs and Aleutians).

Discussion: In some of the specimens the base of the last whorl is convex and in others it is nearly flat. The base may have visible spiral striae or may be smoooth (pl. 2, fig. 11). The axial cords (pl. 1, fig. 9) are prominent in some and faint in others, especially in the last whorl. Sometimes these cords evanesce at the periphery and appear again on the base. There is great variation in the strength of the revolving cord or cords. In the adult specimen from Point Barrow there are two spiral cords on the whorls. The color is whitish gray. Several specimens from Maine have a rosy cast.

Distribution: Parry Islands (Thorson, 1944), Labrador to Rhode Island, Greenland, Iceland, Jan Mayen, Spitzbergen, northern and southern Norway, Russia; Point Barrow to the Aleutians. Point Barrow is a new locality.

Family Liotiidae

Genus *Molleria* Jeffreys, 1865

Molleria costulata (Möller, 1842)

Plate 3, figures 2–5

Margarita costulata Möller, 1842a, p. 10; 1842b, p. 81.
Molleria costulata G. Sars, 1878, pp. 127, 343, pl. 9, figs. 8a–c.—Odhner, 1912, pp. 19, 75, pl. 5, figs. 43–47.

Six living specimens were dredged: 3 at 453 feet, 1 at 477 feet, and 2 at 741 feet. The larger specimen from 741 feet had 2 foraminifers on it, one of them completely filling and covering the umbilical opening.

Other material examined: About 30 specimens from such localities as the Shetlands, Ireland, Spitzbergen, Sweden, Norway, Iceland, Greenland, and Newfoundland.

Discussion: This species is highly variable. To give some idea of this variation, the specimens from Point Barrow have been divided into three general forms:

Form 1. One specimen of about 2.75 whorls from 477 feet (pl. 3, fig. 4) and another of about 2.50 whorls from 453 feet (pl. 3, fig. 3). In both the nucleus is intact. The smaller is light tan in color, the larger dark tan to light brown. The axial sculpturing consists almost entirely of incremental lines. In each shell a beaded spiral cord outlines the umbilicus and terminates at the summit of the peritreme. In the larger, three other spiral cords disappear into the umbilicus and in the smaller there are two and the beginning of a third. In both specimens, just posterior to the outer spiral cord there are the beginnings of axial cords separated by shallow oval depressions. These

axial cords continue across the base to at least the second spiral cord (pl. 3, fig. 4).

Form 2. Typified by a shell of perhaps 3 whorls (nucleus eroded) from 741 feet (pl. 3, fig. 2). The periostracum of this shell is dark brown, appearing almost black when wet. The somewhat wavy and sometimes interrupted axial cords of the last whorl are intermediate between those of Form 1 and Form 3 and are twice as numerous as those in Form 3, hence are narrower and have narrower interspaces between. These cords are interrupted at the base by a beaded cord that surrounds the umbilicus and terminates about the middle of the summit of the peritreme. Two more beaded cords, and a short and inconspicuous third cord, disappear into the umbilicus. The postnuclear whorl has coarser axial cords separated by somewhat wider interspaces than those of the last whorl. A younger specimen, also dark, from 741 feet, has about 2+ whorls and has only the coarse and more widely spaced axial sculpture on the postnuclear 1.5 whorls. This sculpture is interrupted at the base by the spiral cord and two more spiral cords disappear into the umbilicus. A third specimen, from 453 feet, is tan colored, has 2.5 whorls, and axial sculpturing and spiral cords like the smaller specimen above. The nucleus, of one whorl, is intact.

Form 3. One specimen (1.9 mm. in diameter) of 3+ whorls (nucleus eroded), light tan in color, from 453 feet (pl. 3, fig. 5). The axial cords are similar on all the postnuclear whorls; they are coarse, perhaps a trifle coarser than those of the postnuclear whorl of Form 2, and are separated by wider interspaces. The umbilicus is not outlined by a spiral cord, but three short, inconspicuous beaded cords disappear into it. The axial cords are not interrupted at the base, which is convex.

The specimens examined from other localities exhibit all of these variations and more. A specimen from Holsteinborg, Greenland, has prominent axial cords, another from Gothaab has coarse and fine ribs on the same shell. Three shells from Newfoundland have fine to very fine axial sculpturing—too fine to designate as "ribs." Several specimens from Davis Strait also have fine axial sculpturing. In some shells from Spitzbergen there are no visible cords or threads around the umbilicus, in others there are faint threads and in others there are as many as four to seven. In some shells there is neither an angle at the base nor beading of the spiral cord or thread, in others there is no angle, the base is rounded, but the spiral cord is beaded.

The variations described above cannot be accounted for on the basis of depth nor on the type of bottom, for all three of the forms mentioned above from Point Barrow were found at 453 feet.

DISTRIBUTION: The Parry Islands and Newfoundland to Cape Cod (Thorson, 1944), Great Britain, Sweden, Norway, Iceland, Greenland. This species is new to Alaska. The Point Barrow specimens represent a westward extension of range from about long. 120° to 156° W.

Order CTENOBRANCHIA

Suborder PTENOGLOSSA

Family EPITONIIDAE

Genus *Epitonium* Röding, 1798

Epitonium greenlandicum (Perry, 1811)

PLATE 5, FIGURES 2, 3

Scalaria greenlandica G. Perry, 1811, appendix, pl. 28, fig. 8.
Epitonium groenlandicum Morris, 1951, p. 122, pl. 27, fig. 6.—Clench and Turner, 1952, p. 320, pl. 131, fig. 2; pl. 154, figs. 1–3.

Twenty specimens were collected at depths ranging from 110 to 522 feet but only four of these were living; the others were usually worn or broken and encrusted with barnacles and bryozoans. Two live specimens (38 and 39 mm. long) were taken at 152 feet, 1 (36 mm.) at 216 feet, and 1 (25.5 mm.) at 328 feet. The dead shells range between 11.5 and 59.0 mm. in length. Except for a narrow brownish border around the thin edge, the operculums of these specimens are jet black.

OTHER MATERIAL EXAMINED.—About 30 specimens from the Aleutians and from 15 miles north of Cape Prince of Wales.

DISTRIBUTION: Spitzbergen south to southern Norway, Godhavn, Greenland, south to Montauk Point. L. I. (Clench and Turner, 1952); coasts of Siberia and Alaska south to Wrangell and to northern Japan.

Suborder TAENIOGLOSSA

Family LACUNIDAE

Genus *Aquilonaria* Dall, 1887

Aquilonaria turneri Dall, 1887

PLATE 2, FIGURES 8, 9

Aquilonaria turneri Dall, 1887, p. 204, pl. 3, figs. 1–3.

Three live specimens and one shell of this rare species were taken 1 shell (7.9 high by 5.9 mm. wide) at 217 feet; 1 living specimen (6.3, by about 5.0 mm.) at 477 feet; 1 (4.0 by 3.5 mm.) at 453 feet; and 1 (14.3 by 10.2 mm.) at 151 feet.

DISCUSSION: In August 1882 L. M. Turner took 3 specimens of this species from the ooze filling the crevices of rocks at Labrador's reef, Ungava Bay, and in the summer of 1885 Captain Healy took

3 specimens from north of Bering Strait. Some of the data on the label of the latter became illegible, but it is known that Captain Healy did not dredge north or east of Icy Cape and always in less than 65 fathoms. The northern range of this species has, therefore, been considered as lat. 66° N. No other specimens of this species have been recorded since 1885.

DISTRIBUTION: Ungava Bay, and north of Bering Strait to Point Barrow. The specimens from Point Barrow extend the known range northward about 5.5 degrees of latitude and eastward at least 5.0 degrees of longitude in the Pacific area of the Arctic, and the range in depth at least 15 fathoms.

Lacunid sp.

Two larval lacunids were taken from 341 feet on Oct. 11, 1949. Since *Aquilonaria turneri* was the only lacunid taken from the area under investigation, these larvae probably belonged to this species. Unfortunately, both specimens were lost in transit.

Family RISSOIDAE

Genus *Cingula* Fleming, 1818

Cingula castanea Möller, 1842

var. *alaskana* Dall

PLATE 17, FIGURES 8, 9

Rissoa castanea Möller, 1824b, p. 82.
Cingula castanea G. Sars, 1878, p. 174, pl. 10, figs. 1a–b.
Alvania castanea var. *alaskana* Dall, 1886, p. 307, pl. 4, fig. 9.

Thirteen specimens were dredged: 3 (about 1.7 mm.) from 175 feet; 1 (about 2.7 mm., and with about 5 whorls or less) from 184 feet; 2 (1 shell dissolved, the other about 1.4 mm., with about 3 whorls) from 216 feet; 1 (about 1.9 mm., with 3 whorls) from 328 feet; 2 (about 1.2 mm., with about 3 whorls or less) from 341 feet; 3 (from about 1.8 to 2.6 mm.; 2 with about 3 whorls, 1 with about 4.5 whorls) from 477 feet; and 1 (about 1.7 mm., with about 4 whorls or less) from 741 feet. (The number of whorls includes the nucleus, which is usually partially eroded away.)

DISCUSSION: These specimens have yellow operculums. The whorls of the shells from 184 and 741 feet and 2 from 477 feet are evenly rounded with flattened spiral bands, separated by narrow incised lines, beginning close to the sutures; the whorls of those from 175, 216, 328, and 341 feet, and of 1 from 477 feet, have a slight

shouldered slope and the spiral bands begin at the slight angle. There is some variation in the number of spiral bands and in the width of the incised line between them.

Dr. Thorson compared these specimens with Möller's types. He states that the structure of these shells is quite identical with those of the types, but that in the type of *C. castanea* the last whorl is somewhat broader and the shell is somewhat larger than the ones from Point Barrow. These differences seem to agree with Dall's description of the differences between typical *C. castanea* and his variety *alaskana* in which he states that the latter has the same number of whorls as the typical form but is only five-eighths the length of typical *C. castanea*, and is much thinner than typical *C. castanea* generally is. Dall also says that in var. *alaskana* the wrinkles extending forward from the sutures are more prominent than in typical *C. castanea*.

The specimen from 184 feet, taken on Aug. 30, 1949, has at least 13 large eggs or embryos on its body, indicating that it is an ovoviparous species.

Distribution: Point Barrow; and (Thorson, 1944) Grinnell Land and Newfoundland to Cape Cod, eastern and western Greenland; northern and eastern Iceland, Spitzbergen, and northern Norway. *C. castanea* has not been reported from the western Arctic.

Genus *Alvania* Risso, 1826

Alvania jan-mayeni? Friele, 1886

Rissoa (*Alvania*) *jan-mayeni* Friele, 1886, p. 27, pl. 11, figs. 6, 7.
Alvania jan-mayeni Morris, 1947, p. 108, pl. 39, fig. 14; 1951, p. 145, pl. 39, fig. 14.

A single living specimen was collected at 741 feet on Aug. 17, 1949.

Discussion: The shell, which was about 1.8 mm. long, was tan, with 2 reddish tan, beaded cords per whorl. The oval, yellow operculum consists of an acentric nucleus with two spirals. The shell, which was somewhat broken, subsequently dissolved, leaving the body and operculum of the animal.

Dr. Thorson, who examined the fragmentary shell, says that the color and the size and structure of the apex agree well with living specimens from eastern Greenland, but the condition of the shell renders positive identification impossible.

Distribution: Point Barrow; and (Thorson, 1944) Newfoundland to Cape Cod, eastern and western Greenland; Jan Mayen, and Spitzbergen.

Family Turritellidae

Genus *Tachyrhynchus* Mörch, 1868

Tachyrhynchus reticulatum (Mighels, 1841)

Plate 5, figure 9

Turitella reticulata Mighels, 1841, p. 50.—Mighels and Adams, 1842, p. 50, pl. 4, fig. 19.

A total of 7 living specimens and 3 shells was dredged: 1 living specimen (18.0 mm. high) from 184 feet; 1 (20.5 mm.) from 438 feet; 2 living specimens and 2 shells (from 6.7 to 22.3 mm.) from 477 feet; and 3 living specimens and 1 shell (from 10.2 to 17.4 mm. high) from 741 feet.

Other material examined: About 45 specimens from localities ranging from the Sea Horse Islands to Plover Bay; about 250 from Captain's Bay, Unalaska Island and vicinity; about 60 from the Shumagins and Kodiak Island; 1 from British Columbia; and about 100 from localities from Labrador to Casco Bay, Maine.

Discussion: In all of the Point Barrow specimens the spiral ridges are worn and the ribs are not prominent. The 45 specimens from north of Plover Bay are like the ones from Point Barrow in being worn and in having inconspicuous ribs and spiral ridges, but in specimens from Captain's Bay southward, both the spiral ridges and ribs are prominent. In a large lot from Captain's Harbor, the ribs and spiral ridges are so prominent that they give the shell a nodulous appearance. All of these latter shells are smaller than those from more northern waters. Even though worn, about one-half of the specimens from localities from Labrador to Maine have the stronger ribbing characteristic of those from the Aleutians. In a specimen from Greenland the ribs and spiral ridges are not prominent on the last whorls, and in another from Dolphin and Union Straits, although less worn than those from Point Barrow, the ribs and spiral ridges are not prominent.

In this species the spiral bands may be flat and broad with only a narrow groove separating them or they may be higher and narrower with a wider sulcus between. Axial ribs may be very prominent or rather insignificant as in the northern specimens.

Tachyrhynchus reticulatum is probably closest to *T. erosum* (Couthouy) but the former is more slender than *T. erosum* and the latter has no axial ribs (see Morris, 1951, pl. 31, fig. 16; 1952, pl. 26, fig. 9; and Abbott, 1954, pl. 21*l*). The latter also has four or five low, narrow, rounded spiral striae on the base of the last whorl.

Distribution: Greenland, Labrador, and Nova Scotia to Casco Bay, Maine; Point Barrow and west and south to Bering Sea and east and south to the Aleutians and British Columbia.

Family Triphoridae

Genus *Triphora* Blainville, 1828

Triphora perversa (Linnaeus, 1758)

Plate 3, figure 6

Trochus perversus Linnaeus, 1758, p. 760.
?*Cerithium perversum* Bruguière, 1792, p. 496.

One immature specimen was dredged at 341 feet. Including the nucleus, it has 8 whorls and is 2.5 mm. long by 1.3 mm. in diameter; it is reddish brown in color, with lighter nodules.

Other material examined: About 55 specimens from the British Isles, 2 from Norway, and 13 from Tangier Bay, Sicily, and the Aegean.

Discussion: This species is new to Arctic waters. The only other specimens collected north of the British Isles are those from Lofoten, Norway. Because of its small size and inconspicuous coloring, it has doubtless been overlooked in collections.

Distribution: Point Barrow, Alaska; Dr. Thorson (personal communication) gives the Atlantic range as coast of Norway from Lofoten south, western Sweden, Denmark, the Shetlands, Orkney Islands, Great Britain, Ireland, coast of Europe to Madeira and the Canary Islands; also covers the Mediterranean.

Family Crepidulidae

Genus *Crepidula* Lamarck, 1799

Crepidula grandis Middendorff, 1849

Plate 1, figure 11; Plate 5, figure 7

Crepidula grandis Middendorff, 1849b, p. 18; 1849c, p. 101, pl. 11, figs. 8–10; 1849d, p. 429, pl. 11, figs. 8–10.—Kira, 1954, p. 28, pl. 14, fig. 3.

Fourteen live specimens and 2 shells were collected at depths of 120 to 453 feet. In August 1949 one live specimen with a shell 10 mm. long was washed ashore during a storm. Its shell was covered with the soft, encrusting bryozoan *Alcyonidium polyoum* (Hassall). This species is ordinarily attached to rocks but one specimen 6.5 mm. long was found among a foliaceous bryozoan at 120 feet (Sept. 15, 1948). Although *C. grandis* is the largest *Crepidula* known, the ones from Point Barrow were small, ranging from 4.7 to 32.0 mm. in length, only three exceeding 20.0 mm.

Other material examined: One dead shell from Icy Cape, 2 from Point Franklin, 1 small living one from "north of Bering Strait," and about 100 specimens from Kamchatka, Plover Bay, the Pribilofs, and other localities south and east to Sitka, Alaska.

DISCUSSION: The shell is white, both inside and out, and older specimens become rough and coarse. It is covered by a tan periostracum that is usually worn off in a large area around the apex and is often folded and overlapped around the periphery. There are variations in the relation of height to width: some are high and narrow, others flat and wide, with all gradations between.

DISTRIBUTION: Point Barrow, south and east to Sitka. Also Kamchatka. It is new to Point Barrow.

Family TRICHOTROPIDAE

Genus *Trichotropis* Broderip and Sowerby, 1829

Trichotropis bicarinata (Sowerby, 1825)

Turbo bicarinatus Sowerby, 1825, appendix, p. 12.—Broderip and Sowerby, 1829, p. 374, *Turbo*, pl. 9, figs. 4–8.

Trichotropis bicarinata Hirase, 1951, pl. 91, fig. 14.—Abbott, 1954, p. 168, pl. 24a.—Kira, 1954, p. 27, pl. 13, fig. 13.

Six living specimens and 3 dead shells were collected: 1 (10.8 mm. in diameter) from 130 feet; 2 dead shells (33.6 mm. and 37.5 mm.) from 420 feet; 2 (9.8 and 11.7 mm.) from 438 feet; 2 living (9.5 and 32.2 mm., and 1 dead (42.5 mm.) from 453 feet; and 1 living (4.8 mm. in diameter) from 477 feet.

OTHER MATERIAL EXAMINED: Numerous specimens from the Sea Horse Islands, Cape Sabine, Bering Strait, Plover Bay, St. Paul Island, Nunivak Island, and 2 large specimens from deep water off Nemuro, Yesso, Japan.

DISCUSSION: The specimens from Point Barrow present no great differences from the typical. There were none of Dall's variety *alta* (which is merely a more slender form), nor of his variety *spectabilis* (which has unusually prominent processes of periostracum extending from the keels).

DISTRIBUTION: Point Barrow south to Nunivak Island, and northern Japan; the east coast of North America. It has been reported from Greenland and Iceland, but Thorson (1944) does not list it. It has not been reported previously from north of Icy Cape in the Alaskan Arctic.

Trichotropis borealis Broderip and Sowerby, 1829

Trichotropis borealis Broderip and Sowerby, 1829, p. 375.—Morris, 1947, p. 117, pl. 39, fig. 17; 1951, p. 153, pl. 39, fig. 17; 1952, p. 103, pl. 26, fig. 10.—Abbott, 1954, p. 167, pl. 24d.

Only 2 specimens of this species were taken, both living: 1 (14.0 high by 10.3 mm. in diameter) from 130 feet (Sept. 15, 1948); and 1 (16.3 by 11.5 mm.) from 130 feet (Aug. 9, 1949).

OTHER MATERIAL EXAMINED: Numerous specimens from the British Isles, Norway, Iceland, Greenland, Labrador, Maine, and Massachusetts; also from Franklin Bay, Canada, and from localities from Bering Strait to the Queen Charlotte Islands, British Colombia; 4 specimens from Sakhalin Island.

DISCUSSION: There is variation in the degree of flaring of the outer lip, some shells are noticeably longer and narrower than others, and in some the last whorl enlarges much more abruptly than in others. There is also variation in the degree of "hairiness" or number and size of the "bristle-like appendages" of the periostracum. About half of the specimens from Sitka and farther south are relatively long and narrow, while those from Kodiak Island northward tend to be broader, with a more flaring mouth.

DISTRIBUTION: Spitzbergen, Norway, the Faroes, the British Isles, Iceland, Greenland; Parry Island, Melville Island (type locality), and Franklin Bay, Canada, and Labrador to Massachusetts; Point Barrow south and east to the Aleutians and the Queen Charlotte Islands. It is new to Point Barrow.

***Trichotropis kroyeri* Philippi, 1849**

Trichotropis kroyeri Philippi, 1849, p. 175.—Dall, 1921, p. 149, pl. 11, fig. 1.—Oldroyd, 1927, pt. 3, p. 42; pt. 2, pl. 31, fig. 14.

Six specimens, five of which were empty shells, were dredged from 6 stations ranging from 80 to 477 feet. The smallest shell is 16.0 high by 11.5 mm. in diameter; the largest, 38.0 by 24.5 mm.; the living shell, 19.0 by 13.5 mm.

OTHER MATERIAL EXAMINED: Five specimens from Spitzbergen (type locality); about 50 from Point Barrow (1 dead shell, Ray Exped.), Cape Prince of Wales, the Shumagins, off Seniavine Island, off the Kudobin Islands, and off Bristol Bay.

DISCUSSION: There is considerable variation in the proportion of the length to the diameter; 3 specimens from off the Pribilof Islands and several from Spitzbergen are rather squat, and the latter have a distinct carina. In 4 specimens from Spitzbergen, the spiral cords are fewer and sharper and the shell is thinner than in the Alaskan specimens.

DISTRIBUTION: Spitzbergen (type locality); Point Barrow through Bering Strait to the Shumagins.

Family NATICIDAE

Egg "collars" of *Natica clausa* came up with the first dredge hauls made after the ice went out and were present throughout the summer and into the middle of October. One collar taken at 453 feet on Oct. 11, 1949, had one young snail in each egg space.

Egg collars of *Polinices* also appeared in dredge hauls from the first of the open season until the last of October. Not infrequently, collars and fragments of collars washed ashore. Most of the *Polinices* egg collars appeared much too large to belong to *P. monteronus* and *P. pallidus* of the sizes that were dredged, indicating that larger *P. pallidus* occurred farther offshore in deeper water or that some other larger species occurred there. Of 8 egg collars of *Polinices* that appeared in August, 3 were old and 5 were medium in age; of 11 taken on Sept. 26, 1949, 3 were old, 5 medium, and 3 were fairly fresh; of 5 taken on Oct. 3, 1949, 3 were freshly deposited and 2 were somewhat older; and one taken on October 28, 1949, had been deposited recently.

Larvae in egg collars deposited during the latter part of October undoubtedly spend the remainder of the winter developing and do not escape until early summer, but it is interesting to speculate on what happens to young naticids that are still in egg collars in the middle of October. It seems strange to think of them remaining in the egg collars until open water about nine months later, and equally strange to think of them spending their first months out of egg capsules during the depth of winter.

Genus *Natica* Scopoli, 1777

Natica clausa Broderip and Sowerby, 1829

PLATE 1, FIGURE 10; PLATE 12, FIGURE 8

Natica clausa Broderip and Sowerby, 1829, p. 372.—Odhner, 1913, pp. 7, 14, pl. 3, figs. 1–3, 5–14, 16, 17; pl. 5, figs. 7–14.—Dall, 1921, p. 163, pl. 14, fig. 11.—Oldroyd, 1927, pt. 3, p. 122, pl. 97, fig. 2.—Morris, 1947, p. 97, pl. 29, fig. 5; 1951, p. 133, pl. 29, fig. 5; 1952, p. 94, pl. 24, fig. 25.

Eluitkak Pass and practically every station deeper than 110 feet yielded from 1 to 5 specimens of *N. clausa*, and on three occasions during storms living specimens were cast ashore. Fourteen living specimens were taken from 213 feet and 11 from 453 feet. The largest shell (about 27 mm. in height) came from 213 feet; the smallest (7.0 mm.) from 162 feet; another small one (8.7 mm.) from 295 feet; another (7.9 mm.) from 213 feet; and still another (7.7 mm.) from 110 feet (September 8, 1948).

OTHER MATERIAL EXAMINED: Over 40 specimens from Novaya Zemlya, the Kola Peninsula, Spitzbergen, Norway, the Shetlands; several from off Labrador, Greenland, and the coast of Maine; about 40 from localities from Point Barrow to the Pribilofs, the Aleutians, Kamchatka, Sakhalin Island, and Japan.

DISCUSSION: The nucleus and at least the first postnuclear whorl of the Point Barrow specimens are badly eroded in even the youngest. There is variation in the length of the spire, in the degree of convexity of the whorls, in the degree of flattening at the suture, in the thick-

ness of the shell, and in the color, which ranges from pale olive-straw to brown. Many of the shells show scars where they have been repaired after being crushed; and many are pitted from the inroads of other animals.

DISTRIBUTION: Circumpolar.

Genus *Polinices* Montfort, 1810

Polinices pallidus (Broderip and Sowerby, 1829)

PLATE 12, FIGURE 10

Natica pallida Broderip and Sowerby, 1829, p. 372.
Lunatia pallida Odhner, 1913, pp. 8, 31, pl. 3, figs. 15, 19–37; pl. 4, figs. 1–8; pl. 5, figs. 16–18.
Polinices pallida Dall, 1921, p. 165, pl. 14, fig. 5.—Oldroyd, 1927, pt. 3, p. 126, pl. 97, fig. 9.

Ten specimens were taken: 1 living (9.4 mm. in diameter) from 120 feet (Aug. 8, 1949); 1 dead (26.4 mm.) from 130 feet (Sept. 15, 1948); 2 living (8 mm. and 13 mm.), from 162 feet; 1 living (17.5 mm.) from 341 feet; 2 living (about 13 mm., each) from 477 feet; 2 living (14 mm. and 17 mm.) from 741 feet; and 1 dead (19 mm.) from Eluitkak Pass. Tiny barnacles nestle in the sutures and in the pitted areas of even the living shells.

OTHER MATERIAL EXAMINED: Numerous specimens from localities ranging from the Sea Horse Islands south and east to the Aleutians and Puget Sound.

DISCUSSION: Even in the living shells from Point Barrow, and from such Arctic localities as Icy Cape, the periostracum and part of the shell structure are eroded over the nucleus and postnuclear whorls, and in one the body whorl is pitted and eroded. There is considerable variation in the height of the spire, in the suture, and in the degree to which the umbilicus is open; and one shell may be nearly twice as heavy as another of comparable size. The color ranges from a light olive-gray or a ripe straw to light and medium brown.

DISTRIBUTION: Northern and southern Norway, Spitzbergen, Jan Mayen, Iceland, Greenland; Melville Island south to Labrador and Cape Cod; Point Barrow south and east to the Aleutians and west to the Sea of Okhotsk, south to Puget Sound; and in deep water off Redondo Beach, Calif.

Polinices monteronus (Dall, 1919)

PLATE 12, FIGURE 9

Euspira monterona Dall, 1919b, p. 352.
Polinices monterona Dall, 1921, p. 164.

Eight living specimens were collected: 1 at 125 feet, 1 at 175 feet, 1 at 184 feet, 1 at 295 feet, 1 at 420 feet, 2 at 522 feet, and 2 at 741 feet.

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The largest shell is 19.3 mm. in diameter, the smallest about 13.5 mm. Two empty shells were also taken.

OTHER MATERIAL EXAMINED: The type, from Captain's Harbor, Unalaska Island, in the Aleutians; and about 10 specimens from the following localities: Kotzebue Sound, near the Pribilofs, Amchitka Island in the Aleutians, and southeast of the Alaska Peninsula.

DISCUSSION: Time did not permit a thorough study of other northern species of *Polinices*, but it is obvious that *P. grönlandicus* and *P. pallidus*, especially the young, have been confused with *P. monteronus*. In most specimens of the latter, the umbilicus is almost or completely closed by the callus and the enamel of the inner lip, but in others the umbilicus is scarcely concealed at all. In some young specimens of *P. pallidus* the umbilicus is partially covered with enamel in such a manner that it closely resembles the notched callus of specimens of *P. monteronus* with the more open umbilicus. When a specimen of *P. pallidus* with this type of callus also has an unusually short spire, it is easily confused with *P. monteronus*. In such instances, the greatly thickened pillar lip of *P. monteronus* is diagnostic, for it is about twice as broad as that of *P. pallidus* (see pl. 12, figs. 9, 10). As in the preceding species, the nucleus and the postnuclear whorl are nearly always eroded.

DISTRIBUTION: Point Barrow south to Amchitka Island (about lat. 52° N.) in the Aleutians, and east and north to Prince William Sound.[6] It has not been reported previously from north of Kotzebue Sound.

Family LAMELLARIIDAE

Genus *Onchidiopsis* Bergh, 1853

Onchidiopsis glacialis (M. Sars, 1851)

Lamellaria glacialis M. Sars, 1851, p. 185.
Onchidiopsis glacialis G. Sars, 1878, p. 153, pl. 12, figs. 6a–c.—Odhner, 1913, p. 73, pl. 2, figs. 17, 18, 23, 24; pl. 5, figs. 3, 5, 32, 33.

In the open season of 1949, 15 specimens washed ashore: 2 in July, 3 in August, and 10 in September. One was dredged at 420 feet in August, and another at 453 feet in October. The largest of these, washed ashore in July, measured, when crawling, 34 mm. long, and the foot extended posteriorly beyond the body an additional 10 mm. The tentacles were 11 mm. long, the siphon 7 mm. long, and the largest tubercles were about 5.5 mm. high. When preserved, this same animal measured about 29 mm. long, 18 mm. wide, and 13.5 mm. high. After preservation, the smallest specimen, dredged in October, measured 18 by 12 by 10 mm. The shell from a somewhat contracted

[6] For more detailed locality records for many of the West Coast species, the reader is referred to Burch (1945–1946).

specimen that measured 28 mm. long, 18 mm. wide, and 14 mm. high is 17 mm. long and 12 mm. wide.

In life, the general color of these animals was tan to brown on a dusky white background. Fine, chalk-white dots were scattered over the background, and there was an occasional larger, pale lemon dot that looked like an aggregation of small dots. Fine lines of brown extended up the tubercles along the ridges. There were ridges and convolutions around the outer edge of the foot, and in each groove there was a fine line of tan.

Distribution: The Kara Sea, Novaya Zemlya, the Murman Coast, Finmarken, Spitzbergen, Hope Island, Bear Island, Iceland, and Greenland (Thorson, 1944). It is new to North America and the Pacific area of the Arctic.

Onchidiopsis groenlandica Bergh, 1853

Variety

Onchidiopsis groenlandica Bergh, 1853, p. 346, pl. 2.—Odhner, 1913, pp. 12, 74, pl. 2, figs. 19, 25; pl. 5, figs. 1, 6.

Onchidiopsis groenlandica Bergh var. *pacifica* Bergh, 1887, p. 278, pl. X, figs. 18, 22; pl. Y, fig. 19; pl. Z, fig. 23.—Odhner, 1913, p. 75.

A single specimen of what apparently belonged to this species was washed ashore in July 1948, but it was subsequently lost. The entire notaeum was bright orange and much smoother than that of *O. glacialis*. In its semicontracted state, the animal was about 27 mm. long.

Distribution: Odhner (1913) gives the distribution as follows: Spitzbergen, Norwegian Islands, in the stomachs of cod; western Greenland, Grinnell Land, Iceland; and the var. *pacifica* Bergh from Kyska Harbor in the Aleutians. It is new to the Alaskan Arctic

Genus *Piliscus* Lovén, 1859

Piliscus commodus (Middendorff, 1851)

Plate 5, figures 4–6

Pilidium commodum Middendorff, 1849d, p. 427 (no description); 1851, p. 214, pl. 17, figs. 4–11.

Pilidium radiatum G. Sars, 1878, p. 144, pl. 8, figs. 6a–d.

Eighty-five specimens, with shells ranging from 5 to 26 mm. in length, were collected. One washed ashore during a storm in September 1949, and seven during a storm in August 1950; the snails were still intact in their shells but most of them had died from exposure on shore and several of the shells were broken. One was dredged at Eluitkak Pass (40 feet), where the bottom is stony. The remaining 76 specimens were dredged at depths ranging from 120 (1 specimen) to 453 feet. The greatest number, 43, from any one haul was secured

at 175 feet; 2 of these are 5.5 mm., 1 is 18 mm., and the others average 12.2 mm. in length. Nine specimens (from 5 to 17 mm.) came from 453 feet; 6 (from 9 to 20 mm.) from 341 feet; and 6 (from 11 to 18.5 mm.) from 216 feet.

OTHER MATERIAL EXAMINED: Specimens from the Sea Horse Islands, Nunivak Island, St. Paul Island, and the Sea of Okhotsk.

DISCUSSION: The shells are covered with a yellowish periostracum that is worn away only in a small area at the apex. With the exception of 5 specimens, all of the Point Barrow shells of this species are white inside; the insides of the 5 specimens are marked with radiating lavender rays (pl. 5, fig. 5). Of the specimens examined from other localities, only 3 are from north of the 60th parallel: 1 from the Sea Horse Islands, 1 from "north of Bering Strait," and 1 from the "Arctic Ocean." Nearly all of the specimens examined from south of Bering Strait are characterized by the radiating lavender rays on the inside and even in some of the specimens that appeared white the rays could be detected by holding the shell to the light.

DISTRIBUTION: This species ranges from Point Barrow to the Pribilofs, Bering Sea, and the Sea of Okhotsk. Johnson (1934) and LaRoque (1953) give the Atlantic range as "off Nova Scotia in 150 fathoms."

Genus *Velutina* Fleming, 1820

Velutina undata Brown, 1839

And var. *zonata* Gould, 1841

PLATE 6, FIGURES 1–3

Velutina undata Brown [7] *in* Smith, 1839, p. 102, pl. 1, fig. 15.—Brown, 1849, p. 255.—Odhner, 1913, pp. 11, 55, pl. 2, figs. 1–10, 15; pl. 5, figs. 27, 28.
Velutina zonata Gould, 1841, p. 242, fig. 160.
Morvillia undata G. Sars, 1878, p. 147, pl. 21, figs. 7a–b.

Six specimens were collected: 2 shells (23 mm. and 27.5 mm. long) from Eluitkak Pass on Aug. 10, 1948; 1 shell (10 mm.) from 204 feet; 1 living specimen (4.5 mm.) from 217 feet; 2 specimens (8 mm. and 19.6 mm.) from 453 feet; and 1 living specimen (15 mm.) from 741 feet.

OTHER MATERIAL EXAMINED: One specimen from Lofoten Island, Norway; 2 from Spitzbergen; about 55 from localities from Murray Bay, Quebec, to Eastport, Maine; over 20 from localities from Icy Cape to the Kudobin Islands.

[7] European authors list this species as "*Velutina undata* Brown, 1838," and Sherborn (1932) as "*Velutina undata* Smith, 1839." The latter date is correct, but the description should be credited to Brown. On page 102 of Smith (1839) a heading for the description of this species appears as "*Velutina undata*. n. s.—Smith," but the end of the description on page 103 is followed by "—*B*." In a footnote on page 98, Smith states "The descriptions marked *B*, I owe to Mr. T. Brown, and those marked *F*, to Mr. Edward Forbes." In view of the heading to the description, it is small wonder that Sherborn credited the description to Smith.

Discussion: This is the shell that has commonly been called *V. zonata* Gould by West Coast workers. The 2 specimens from 453 feet are typical forms; the one from 217 feet is probably var. *zonata* Gould. In typical *V. undata* the inner lip is broader and more excavated than in var. *zonata* and the outer lip is expanded and extends above the spire; in var. *zonata* the outer lip is not expanded and does not rise beyond the apex. In the Point Barrow specimens the calcified inner layer varies from chalky white to bluish white and the cuticulum varies from a dull tan to pale brown.

Distribution: Circumpolar; Siberian, Russian, Norwegian, Canadian, and Alaskan Arctic; Scotland, the Faroes, Iceland, Greenland, south to Maine; Point Barrow south to the Kudobin Islands. A questionable record from Monterey Bay. It is new to Point Barrow.

Velutina velutina (Müller, 1776)

And var. *schneideri* Friele

Plate 6, figures 4, 5

Bulla velutina Müller, 1776, p. 242.
Velutina laevigata G. Sars, 1878, p. 146.—Oldroyd, 1927, pt, 3, p. 140, pl. 92, fig. 8.—Abbott, 1954, p. 175, pl. 22n.
Velutina schneideri Friele, 1886, p. 26, pl. 11, figs. 3, 4.
Velutina velutina Odhner, 1913, pp. 11, 60, pl. 1, figs. 17–26; pl. 5, figs. 22, 24.

Possibly 4 specimens were collected: 1 (8 mm.) from 453 feet; 1 (14.5 mm.) from 741 feet; and 2 small, living specimens (4 mm. and 2.75 mm.) from 453 feet and 420 feet, respectively, probably belong to this species.

Other material examined: About 100 specimens from Norway, Spitzbergen, Shetland, Scotland, and Greenland; about 25 from localities from Newfoundland to Massachusetts; about 15 from localities from Icy Cape to Kodiak Island, and Puget Sound.

Discussion: This is the species commonly referred to as *V. laevigata* Linnaeus by West Coast workers. The Point Barrow specimens are white within and have a thin, horn-colored periostracum. The largest specimen, from 741 feet, has a smoother periostracum, characteristic of the var. *schneideri* Friele, 1886. The 8-mm. specimen from 453 feet is a typical *V. velutina,* in which the longitudinal ridges of the periostracum are distinct (see Odhner, 1913, pl. 1, figs. 17–23, 26; pl. 5, figs. 22, 24). In var. *schneideri* the calcareous layer is thin and the longitudinal cuticular ridges are indistinct or absent (see Odhner, 1913, pl. 1, figs. 24, 25; pl. 5, fig. 23).

This species has been reported from Monterey Bay and the coast of California. The California specimens that I examined are consistently small; they are higher and flare less than *V. velutina;* the striae of the periostracum are closer than in *V. velutina* and these

striae are closely beset with hairs; the shell is more heavily calcified than in *V. velutina*. Shells of *V. velutina* from Norway and Maine that are the same size as those from Monterey Bay look entirely different. The California specimens may be a new species.

DISTRIBUTION: The Siberian, Russian, and Norwegian Arctic; coast of Norway south to Portugal (rare); eastern Canada and Newfoundland south to Cape Hatteras (Thorson, 1944); Point Barrow, south through Bering Sea and east and south to Puget Sound; also Kamchatka. It is new to Point Barrow and this name is new to the Pacific.

***Velutina plicatilis* (Müller, 1776)**

And var. *cryptospira* Middendorff

PLATE 6, FIGURES 6, 8–10

Bulla plicatilis Müller, 1776, p. 242.
Helix coriacea Pallas, 1788, p. 243, pl. 7, figs. 31, 33.
Velutina cryptospira Middendorff, 1849b, p. 18; 1849d, p. 435; 1851, p. 216, pl. 25, figs. 8–10.
Velutina sitkensis A. Adams, 1851, p. 225.
Velutella cryptospira G. Sars, 1878, p. 149, pl. 21, figs. 9a–b.
Velutina plicatilis Odhner, 1913, pp. 12, 67, pl. 1, figs. 12–16; pl. 5, figs. 25, 26.

From Aug. 17 to Oct. 5, 1949, 9 specimens washed ashore; 1 washed ashore on July 26, 1950; 1, living (17 mm. long), was dredged at 10 feet on Sept. 8, 1949; 1 (11 mm.) at 175 feet; and 1 (12 mm.) at 741 feet. Even the majority of those that washed ashore were still living. The shells range in length from 17 to 26 mm.

OTHER MATERIAL EXAMINED: Over 30 specimens from localities from Icy Cape to the Pribilofs, the Aleutians, and the Shumagins; 1 from Halifax, Nova Scotia.

DISCUSSION: Most of the specimens from Point Barrow belong to the var. *cryptospira* Middendorff, which is the same as *V. sitkensis* A. Adams; but there are all intergradations between typical *V. plicatilis* in which the spire is fully visible and those specimens in which it is completely hidden (var. *cryptospira*). There has been much confusion regarding the species of *Velutina*, due largely to the great variations within a species. For example, *V. plicatilis* always has a calcareous incrustation in the innermost whorls, and sometimes the outer whorl has a thin calcareous lining, and since it often has spiral sculpture like that of *V. velutina*, well-calcified young of *V. plicatilis* with visible spires and spiral sculpture have sometimes been confused with *V. velutina*. Odhner (1913) gives excellent illustrations of several species of *Velutina* and summarizes the distinctions.

DISTRIBUTION: Spitzbergen, the White Sea, Norway, Belgium, the British Isles, Ireland, Greenland (Thorson, 1944); Halifax and

Newfoundland; Point Barrow south to the Pribilofs and the Aleutians. It has not been reported previously from Arctic Alaska.

Velutina lanigera Möller, 1842

PLATE 6, FIGURE 7

Velutina coriacea of authors (in part) (not *Helix coriacea* Pallas, 1788).
Velutina lanigera Möller, 1842a, p. 10; 1842b, p. 83.—G. Sars, 1878, p. 146, pl. 12, figs. 3a–b.—Odhner, 1913, pp. 11, 65, pl. 1, figs. 27–29.

One empty shell, over 31 mm. long, was washed ashore on Sept. 12, 1949.

OTHER MATERIAL EXAMINED: One specimen from Bering Sea; several from Petrel Bank, Bering Sea; several from Cape Lisburne; and others.

DISCUSSION: This species has been confused with *V. plicatilis* (= *V. coriacea* and *V. sitkensis*) and other species. The earliest whorls of *V. lanigera* are broader and more inflated than those of *V. velutina*, and in shells of the same size *V. velutina* has about one half more whorl than *V. lanigera*. The calcified layer is more reduced in *V. lanigera* than in *V. undata*. The entire shell is longer than that of *V. plicatilis*, it has a much larger spire, and the periostracum is thicker.

DISTRIBUTION: Northern and southern Norway, Spitzbergen, Iceland, western Greenland; Point Barrow south to Petrel Bank, Bering Sea. Careful study of specimens in the U. S. National Museum may extend the range farther south. This species has not been reported previously from North America.

Suborder RACHIGLOSSA

Family MURICIDAE

Genus *Boreotrophon* Fischer, 1884

The northern species of this genus are in need of a thorough study and revision. Gould (1870, p. 377–78) describes *Trophon clathratus* as a small, brownish, ventricose shell with 6 whorls and from 15 to 20 sharp varices. He considers this shell the same as *Trophon bamffius* of English authors. He describes *Trophon scalariformis* as a fusiform, white or reddish brown shell with 7 whorls and from 15 to 20 flexuous varices with jagged edges, usually more elevated at the posterior part of the whorls so as to produce an angular appearance. Bartsch (1921, p. 87) states that the European form is *T. clathratus* and the western Atlantic members are *T. scalariformis*. After examining some Point Barrow specimens identical with our western Atlantic *Boreotrophon scalariformis*, Dr. Gunnar Thorson informed me

that these shells are identical with what they call *B. clathratus* and that the smaller specimens sent him are *B. clathratus* var. *gunneri*. The latter are angulated and are undoubtedly the forms that Gould described as having varices more elevated at the posterior part of the whorls.

The number of varices is a highly variable character in the northern species of *Boreotrophon*. Some varices may be three times as far apart as others on the same whorl and still others may be so close together that they give the appearance of a double varix.

At Point Barrow 2 capsules, each containing 2 embryos, of a species of *Boreotrophon* were dredged at Eluitkak Pass on Aug. 30, 1948.

***Boreotrophon clathratus* (Linnaeus, 1767)**

And vars. *gunneri* Lovén and *scalariformis* Gould

PLATE 7, FIGURES 1–7

Murex clathratus Linnaeus, 1767, ed. 12, p. 1223.
Murex multicostatus Eschscholtz, 1829, pt. 2, p. 11, pl. 9, fig. 4.
Fusus lamellosus Gray, 1839, p. 117, pl. 36, fig. 13.
Tritonium gunneri Lovén, 1846, p. 144.
Fusus scalariformis Gould, 1840, p. 197; 1841, p. 288, fig. 203.
Trophon clathratus G. Sars, 1878, p. 247, pl. 15, fig. 10 (= type).—Morris, 1947, p. 144, pl. 39, fig. 15; 1951, p. 184, pl. 39, fig. 15 (= var. *gunneri*).
Trophon clathratus var. *gunneri* G. Sars, 1878, p. 247, pl. 15, figs. 11, 11a.
Trophon scalariformis Bartsch, 1921, p. 87.—Morris, 1947, p. 144, pl. 39, fig. 11; 1951, p. 185, pl. 39, fig. 11.
Boreotrophon multicostatus Abbott, 1954, p. 207, fig. 46c (= var. *gunneri* Lovén).

Eighteen living and 3 dead specimens were dredged at depths of 110 to 741 feet. The depths of 125, 184, and 295 feet yielded 3 specimens each, and those of 110 (Sept. 15, 1948), 420, and 741 feet yielded two each. The 2 largest specimens are 39.5 mm. long; the smallest, 28 mm. Foraminifers and hydroids are common on these shells.

The var. *gunneri* Lovén is represented by 8 living and 5 dead specimens from depths of 80 to 741 feet, 4 of the living specimens coming from depths of 438 to 741 feet. The largest living specimen is 28.5 mm. long; the smallest, 18.5 mm. Foraminifers and hydroids are common on these shells also.

OTHER MATERIAL EXAMINED.—About 30 specimens of *B. clathratus* from St. Peter's Bank, the Grand Banks, and Newfoundland; 1 from Massachusetts Bay; about 15 from western Greenland; and 1 from Spitzbergen.

DISCUSSION.—There are variations in the length and arcuateness of the canal and in the degree to which it is reflected; there are from 15 to 19 varices in the Point Barrow specimens of *B. clathratus*. One speci-

men about 35 mm. long from 125 feet has a long, narrow canal, slightly reflexed, but not arcuate, suggesting a variety of *B. cepulus*. The specimen of var. *gunneri* from 438 feet also has a long canal, but it is arcuate and not so narrow as in the *B. clathratus* from 125 feet. In a specimen of var. *gunneri* from 125 feet there are only 9 or 10 varices, which extend outward markedly from the posterior end of the last whorl. In other specimens of var. *gunneri* from Point Barrow the varices number up to 15; there is great variation in the depth of the varices (which is reflected in the degree of angulation at the shoulder), in the length of the canal, and in the proportion of the length of the spire to the length of the aperture and canal.

DISTRIBUTION: Baffin Land to Cape Cod; Greenland; Iceland, the Hebrides, England, the Faroes, Norway, Spitzbergen, Novaya Zemlya, White Sea, Franz Joseph Land, the Siberian Arctic. Thorson (1944) also lists Bering Strait, Alaska, Puget Sound, and Japan, but none of our western literature mentions *B. clathratus* or even var. *scalariformis*. I believe that the Point Barrow specimens form the first published record of *B. clathratus* from Alaska and the Pacific area (although Gray's *Fusus lamellosus* (1839), which was from Icy Cape is undoubtedly *B. clathratus*). However, I also believe that careful study of specimens of *B. beringi*, and perhaps *B. pacificus*, in the U. S. National Museum will reveal specimens of *B. clathratus* and var. *gunneri* taken from south of Bering Strait.

***Boreotrophon beringi* (Dall, 1902)**

PLATE 7, FIGURES 11, 12

Trophon beringi Dall, 1902, p. 544; 1921, p. 109, pl. 10, fig. 6.—Oldroyd, 1927, pt. 2, pl. 30, fig. 6; pt. 1, pl. 18, fig. 8.

Seventeen living and 7 dead specimens were collected: 3 living and 2 dead specimens washed ashore in September 1949; 1 dead specimen came from 110 feet; the remainder were dredged from 11 stations from 120 (Aug. 8, 1949) to 741 feet, with 4 living coming from 175 feet. The entire spire and part of the last whorl of a specimen from 162 feet were covered with a species of *Syncoryne*.

OTHER MATERIAL EXAMINED: Numerous specimens from localities from Icy Cape through Bering Strait to the Pribilofs, the Aleutians, the Shumagins, Cook's Inlet, and 1 from Puget Sound (see below); also from Kamchatka.

DISCUSSION: In the specimens from Point Barrow the varices vary from 17 to 25, the majority of the shells having from 19 to 21. This species has a wider canal than *B. clathratus*, a more tumid body whorl, and the varices do not project so far. Out of 117 specimens examined in the collection of the U. S. National Museum, only 22 have 12 varices

or less, 65 have from 13 to 16, and 30 have from 17 to 23. Thus it is obvious that relatively few have the small number of varices (9 to 12) given in the original and subsequent description. (The specimen from Puget Sound does not look like *B. beringi*.)

DISTRIBUTION: From Point Barrow through Bering Strait to the Aleutians and Puget Sound (?). Point Barrow is a new locality.

***Boreotrophon pacificus* (Dall, 1902)**

PLATE 7, FIGURES 13, 14

Trophon pacifica Dall, 1902, p. 544; 1921, p. 110, pl. 11, fig. 5.
Trophon pacificus Oldroyd, 1927, pt. 2, p. 35, pl. 30, fig. 4.
Boreotrophon pacificus Abbott, 1954, p. 208, fig. 46f.

Two living and 19 dead specimens were collected: 11 empty shells washed ashore during August and September 1949 and the remaining 8 empty shells were taken from depths of 80 to 741 feet; the 2 living specimens came from 217 and 741 feet. The one from 217 feet was practically covered with the hydroid *Syncoryne*.

OTHER MATERIAL EXAMINED: Numerous specimens from the Aleutians, Kodiak Island, and Port Etches, Alaska.

DISCUSSION: I am not at all confident that I have in every instance been able to distinguish between specimens of *B. beringi* and *B. pacificus* (see also *B. truncatus*). Dall's distinction of more varices in *B. pacificus* than in *B. beringi* is of no value, for he selected for his type of *B. beringi* a specimen with few varices. The Point Barrow specimens of *B. pacificus* have from 15 to 24 varices, the majority having from 16 to 21, covering practically the same range as in *B. beringi*. Nor is the statement that *B. pacificus* "resembles *T. beringi* in miniature" very useful, for there are small specimens of *B. beringi*. I attempted separating these species on the basis of the nucleus and the length and shape of the canal. The nucleus of *B. beringi* seems to be larger and blunter than that of *B. pacificus*. The canal of *B. beringi* seems to be relatively longer and more arcuate than in *B. pacificus*, but a *B. beringi* with an unusually short canal or a *B. pacificus* with an injury that causes the canal to curve more than usual makes this distinction useless.

DISTRIBUTION: This species is said to occur from the Arctic Ocean southward through Bering Sea, the Aleutians, Kodiak Island, and Hinchinbrook Island; Kamchatka; and in deep water off California and Acapulco, Mexico (Dall, 1921, p. 110; Burch, 1945, vol. 2, pt. 1, No. 51, p. 58), but none of the collecting records is from north of Bering Strait. The specimens from Point Barrow, therefore, extend the range of *B. pacificus* into the Alaskan Arctic.

***Boreotrophon truncatus* (Strøm, 1768)**

PLATE 7, FIGURES 8–10; PLATE 8, FIGURES 3, 4, 7, 9

Buccinum truncatum Strøm, 1768, vol. 4, p. 369, pl. 16, fig. 26.
Trophon truncatus G. Sars, 1878, p. 246, pl. 15, fig. 9.—Morris, 1947, p. 144, pl. 39, fig. 1; 1951, p. 185, pl. 39, fig. 1.

Because of difficulties in identification, the exact number of specimens of this species is in question. Two living specimens (17.7 mm. long by 7.6 mm. in diameter, and 16.6 mm. by 7.8 mm.) were taken from 741 feet (pl. 8, figs. 4, 9). Six living specimens (ranging from 6.3 to 11 mm. in length) with from 4 to about 5.5 whorls, and with from 12 to 16 varices (the number not dependent on size of shell), were found among a foliaceous bryozoan from 120 feet (Sept. 15, 1948). The smallest of these was practically covered with a colony of encrusting bryozoans.

Also on this foliaceous bryozoan from 120 feet a *Boreotrophon* measuring 13.9 by 7.2 mm. with 5.5 whorls and with 18 varices was found. The spire of this shell was covered with old hydroid stalks among which were what appeared to be small, irregular, flattish packets of yellowish, oval eggs with a round hyaline dot toward one end. From 217 feet was dredged a similar live shell measuring 11.1 by 5.9 mm. with about 5.25 whorls and with 17 varices. The spire of this shell was covered with a growth of *Syncoryne* (pl. 8, fig. 3). Two living specimens, similar to the two just mentioned, were taken at 184 feet (pl. 8, fig. 7), 1 at 438 feet, and 2, somewhat larger, at 125 feet.

Ten other living specimens and 5 dead shells, all larger than the ones mentioned above, came from depths of 72 to 438 feet.

OTHER MATERIAL EXAMINED: Several specimens from the Jeffrey's collection (now in the U. S. National Museum); several in the collection of the U. S. National Museum; 4 from western Greenland (sent by Dr. Thorson).

DISCUSSION: The 4 specimens from Greenland have about 5.5 whorls and 18 varices; they are beige colored, with beige to dark tan throats. By comparison, the Point Barrow specimens are translucent white to chalky white and the throats are white. The smallest Point Barrow specimens mentioned above are slenderer (pl. 8, fig. 7) than the Greenland *B. truncatus;* the aperture seems a trifle smaller and the canal a little longer than in the Greenland specimens.

These same differences are apparent between the medium-sized Point Barrow specimens and those from Greenland; in addition, the former have somewhat shorter spires and more rapidly increasing body whorls.

The same differences are also found in the largest specimens mentioned above, but in these the canal is even longer, although it is prob-

ably in proportion to the size of the shell. These largest specimens seem to merge into *B. pacificus*.

Dr. Thorson has suggested that these medium-sized and large specimens may be a new variety of *B. truncatus*, but it seems inadvisable to describe a new variety until a thorough study and revision of the northern species of *Boreotrophon* have been made.

DISTRIBUTION: *B. truncatus* is known from the Gulf of Maine; from Greenland; Iceland, the British Isles, the Faroes, northern and southern Norway, Spitzbergen, the Barents Sea, and the Siberian Arctic. It is new to Point Barrow and the Alaskan Arctic.

Family BUCCINIDAE

Genus *Buccinum* Linnaeus, 1758

Masses of egg capsules of *Buccinum* were found from the time the ice went out until the middle of October. Such masses were sometimes dredged but more often were washed ashore during storms. They ranged from masses of less than a hundred capsules to other masses over 6 inches long and from 2 to 3 inches in breadth. The capsules varied in size; some were smooth, others were wrinkled. Toward the end of September one mass of capsules still contained eggs. At the beginning of October one mass belonging to another species was made up of both empty capsules and ones containing eggs. In the middle of October, a mass from still another species contained capsules in which there were from 3 to 5 embryos from 1.8 to 4 mm. in length that were still feeding on "nurse eggs." And on October 16, masses belonging to a fourth species contained capsules with eggs only, while in other masses the capsules held from 10 to 12 embryos without shells; still others contained 4 or 5 larger embryos with "nurse eggs"; one capsule contained 14 embryos in an earlier stage, while still other capsules had from 15 to 17 embryos with eye spots.

Buccinum glaciale Linnaeus, 1761
And var. *morchianum* Dunker

PLATE 9, FIGURES 1–7, 10, 13

Buccinum glaciale Linnaeus, 1761, p. 523.—Tryon and Pilsbry, 1878–1898, vol. 3, pl. 76, fig. 345.—Abbott, 1954, p. 226, pl. 24t.

Tritonium carinatum Dunker, 1858, pt. 1, pl. 2, figs. 3, 4.

Buccinum morchianum Dunker, 1858, pt. 1, pl. 2, figs. 2, 3.—Tryon and Pilsbry, 1878–1898, vol. 3, p. 185, pl. 78, fig. 371.

Buccinum carinatum Tryon and Pilsbry, 1878–1898, vol. 3, p. 185, pl. 78, fig. 372.

Buccinum glaciale var. *parallelum* Dall, 1918, p. 231.

Buccinum glaciale parallelum Dall, 1921, p. 98, pl. 8, fig. 10.—Oldroyd, 1927, pt. 1, p. 239, pl. 17, figs. 9, 10; pl. 27, figs. 1, 2.

Over 50 living specimens of this species were collected from 19 stations. One specimen only came from Eluitkak Pass (40 feet, stony

bottom) and one was taken on Apr. 12, 1950, at a depth of 80 feet by means of a trap through a hole in the ice. The remaining specimens were from depths of 120 to 522 feet, the greatest numbers coming from 125 feet (14), 175 feet (7), 150 feet (4), 420 feet (4), 216 feet (3), and 453 feet (3). Dead shells were usually inhabited by hermit crabs. The largest specimen is about 70 mm. in height; the smallest, 15.5 mm.

Other material examined: Numerous specimens from localities from Point Barrow to Plover Bay and to the Aleutians; 1 specimen from Labrador; over 10 from Spitzbergen.

Discussion: *B. glaciale* is characterized by moderately convex whorls and strong longitudinally oblique folds that are strongest at the sutures and, in the body whorl, terminate at a strong carina that produces an angle about midway of the whorl. It is spirally sculptured by fine threads grouped in bands of from about 4 to 10, sometimes 15 or even more, separated by interspaces varying from one-fourth to one-half the width of the bands. The fine incremental lines that cross these spiral threads give them a wavy appearance, and the interspaces and secondary grooves are likewise crossed by these fine vertical lines.

In some specimens examined the whorls are almost flat (pl. 9, fig. 5), in others they are much more convex than in typical specimens. The shells vary from relatively slender to almost squat, and although the ones with the more convex whorls are usually the more inflated, there are a few wide, squat shells with almost straight whorls. The number and strength of the longitudinal folds vary markedly; in some specimens the folds fade out before reaching the carina (pl. 9, fig. 2) and in others they remain strong and terminate in a nodule at the keel (pl. 9, fig. 4); in some shells these axial folds are regular and in others they are wavy and occasionally they are interrupted somewhat as in *B. tenue*. In some shells the carina or keel is weak (pl. 9, fig. 2), and in a few there is no definite carina (pl. 9, fig. 6); in others there may be two carinae (pl. 9, fig. 1); in still others there may be a cord both above and below the keel; and in still others there may be 3 cords with no angle formed. In a few shells an angle is formed at the termination of the axial folds without a definite carina being present. Sometimes, instead of being drawn into bands, the spiral lirae are more evenly spaced, giving the wavy effect characteristic of *B. angulosum*. In some specimens of *B. glaciale* the mouth is more rounded than oval and the aperture is much less than one half the length of the shell; in others the aperture is nearly as long as the remainder of the shell.

In all except one of the 29 specimens examined from Plover Bay, the shells average much heavier than those from other localities and they also increase in size more rapidly. With one exception, a carina is present but the angulation is slight; one specimen has 2 carinae but is not angular. The spiral striae also tend to be gathered into

wider bands than usual; in a few the bands of striae are coarser and have deeper and wider interspaces.

On the whole, the Point Barrow specimens are fairly typical, but a few run the gamut of variations. In only a few are the carina and angle insignificant, but in one from 125 feet (39.2 mm. high) there is no carina and the whorl is not angled at the termination of the axial folds. An adult shell from 150 feet (65 mm. high) has a small carina and almost no angle; one from 184 feet (42.5 mm. high) has 2 carinae with a suggestion of a third between these two in the last half of the last whorl. The more posterior of these 2 carinae is not half the size of the anterior one but practically all of the axial folds terminate there instead of at the stronger one, which is in the customary position about the middle of the whorl.

A shell measuring 48 mm. high by 24.6 mm. in diameter, with an aperture 20 mm. long and a spire 28 mm. long, that was dredged from 125 feet (pl. 9, fig. 6) has certain characteristics of *B. donovani* Gray: the spire is long and slender and the aperture is relatively short; there is no keel at the shoulder, merely a suggestion of a carina. The axial folds are strong and terminate at the shoulder. The shell is heavier and the whorls less convex than in *B. donovani* that I have examined, and it lacks the patulous aperture and sinuated outer lip of *B. donovani*. It is undoubtedly a variant of *B. glaciale* rather than of *B. donovani*.

DISTRIBUTION: Point Barrow to Juan de Fuca Strait; Johnson (1934) gives the Atlantic range as Greenland to the Gulf of St. Lawrence; Thorson (1944) also lists it from Jan Mayen, Spitzbergen, the Kara and Barents Seas, Franz Joseph Land, Novaya Zemlya, and the Siberian Arctic; also Kamchatka and Japan.

Variety *morchianum* Dunker, 1858

PLATE 9, FIGURES 7, 10, 13

A total of 10 shells, at least half of which were living, were collected: 1 small dead shell washed ashore; 1 dead shell (67.4 mm., the largest) and 2 living (19.5 mm. and 21 mm.) came from 130 feet; 2 living (17 mm. and 47.5 mm.) from 175 feet; 1 living (33 mm.) from 213 feet; 1 living (65 mm.) from 477 feet; 1 recently dead (65.5 mm.) from 453 feet; and 1 living (25.7 mm.) from 522 feet.

OTHER MATERIAL EXAMINED: About 40 specimens from the Pribilofs, the Aleutians, and Cook's Inlet, and 1 from Cape Prince of Wales.

DISCUSSION: This is the shell that was described by Dall in 1919 as *B. glaciale* var. *parallelum*. It differs from typical *B. glaciale* in that the spiral striae are usually somewhat coarser and tend toward fewer per band, with less pronounced and narrower interspaces between

the bands. The secondary grooves between the striae of the bands are usually more prominent in var. *morchianum*. The basal whorl has 2 carinae, one of which is in the same position as that in *B. glaciale;* sometimes it is angled at this carina and sometimes not. The other carina, more apical in position, is usually stronger and extends around the body whorl and one or two more whorls, often forming a sloping shoulder. Where the carina crosses the axial folds, the latter are drawn out into nodules and the folds usually change direction at this point. Young specimens are covered by a thin, closely adherent, slightly fringed periostracum that is usually worn off in larger specimens. Some young specimens are difficult to distinguish from *B. ciliatum*, both the periostracum and the sculpture being similar. They differ from *B. ciliatum* in the presence of the carina and in a slightly more recurved canal and slightly deeper groove behind the canal.

There is great variation in the weight of shells of equal size; some shells are robust, others gradually tapered; some are strongly carinated and angular, others scarcely carinated and are rounded, still others have 3 carinae, and still others have one carina with one or more strong cords; some have fewer, others more ribs than typical specimens; and in some the bands of spiral striae are prominent and sometimes separated by wide interspaces.

Distribution: Point Barrow, Cape Prince of Wales, the Pribilofs, the Aleutians, eastward to Cook's Inlet; the Kurile Islands. The Point Barrow specimens extend the range into the Arctic to the 71st parallel.

Buccinum plectrum Stimpson, 1865

Plate 9, figures 11, 12

Buccinum plectrum Stimpson, 1865, p. 374.—Martini and Chemnitz, 1883, ed. 2, pl. 91, fig. 2.—Oldroyd, 1927, pt. 1, p. 239, pl. 5, fig. 5.—Morris, 1952, p. 122, pl. 28, fig. 25.

Approximately 40 live specimens and about 15 shells (in various stages of decomposition), that were either empty or occupied by hermit crabs, were collected. One live specimen was taken on May 17, 1950, at a depth of 37 feet by means of a trap lowered through a hole in the ice. All the other living specimens came from 16 stations from depths ranging from 120 to 522 feet, the highest number, 13, coming from the latter depth. In only three instances was there more than 1 specimen from any station of less than 341 feet: 3 from 295 feet, 3 from 120 feet (Sept. 15, 1948), and 2 from 125 feet. The largest shell was nearly 70 mm., the largest living one about 60 mm., and the smallest living one about 20 mm. in height. Foraminifers, bryozoan colonies, and barnacles up to 8 mm. in diameter were present

on living shells. In some specimens the outer portion of the ribs is worn flat.

OTHER MATERIAL EXAMINED: Numerous specimens from localities ranging from Point Barrow to Nunivak Island, the Pribilofs, the Aleutians, the Inland Passage, and Puget Sound.

DISCUSSION: This is one of the commonest species of *Buccinum* in the area investigated off Point Barrow base. In general appearance it is most closely allied to *B. tenue*, but the shell is heavier, the throat is whiter, and the longitudinal folds or plications are stronger and appear to be less numerous than in *B. tenue*. However, because of the broken or interrupted character of the plications in *B. tenue*, this difference in number is more apparent than real. In *B. tenue* the spiral sculpturing is fine and nearly uniform, whereas in *B. plectrum* the spiral threads are coarser and are grouped into fascicles of four or more separated by a narrow interspace.

Shells of *B. plectrum* from Point Barrow are heavier than those from other localities (with the exception of a large specimen from Chichagoff Island). This characteristic applies to both the shells of the present collection and those in the U. S. National Museum that were collected years ago. Not only is the shell heavier but the groups of spiral threads are also heavier and raised higher. The height of the raised sculpture, or groups of spiral threads, seems to be in direct proportion to the weight of the shell.

In addition to having a heavy shell, the specimen from Chichagoff Island has constricted sutures, prominent ribs (that do not extend to the canal), a flared mouth, and dark color. It might be said to bear the same relationship to *B. plectrum* that var. *rhodium* does to *B. tenue*.

In some shells of *B. plectrum* the longitudinal folds are interrupted or broken, much as in *B. tenue*, but examination reveals that more often than not this interruption has been caused by injury. In some shells, instead of the spiral threads being crowded into fascicles and separated by distinct grooves or interspaces, the spiral threads are more nearly uniformly spaced and the interspaces are shallow, giving the effect of a missing thread rather than a definite groove. In one specimen examined from Afognak Bay the lip had been broken and in the repaired portion of the shell the sculpture was much finer than in the preceding part of the whorl and the spiral threads were not grouped into fascicles or bands. Had two entire shells had such different sculpturing, it is probable that they would be assigned to different species. There is also variation in the convexity of the whorls and in the degree of constriction of the sutures.

DISTRIBUTION: The Pacific range of *B. plectrum* is from Point Barrow to Puget Sound; Johnson (1934) gives the Atlantic range as

Greenland to the Gulf of St. Lawrence, but Thorson (1944) does not list it from Greenland.

Buccinum tenue Gray, 1839

PLATE 9, FIGURES 8, 9

Buccinum tenue J. Gray, 1839, p. 128, pl. 36, fig. 19.—Morris, 1947, p. 150, pl. 36, fig. 3; 1951, p. 196, pl. 36, fig. 3.—Abbott, 1954, p. 225, pl. 24u.

Seven living specimens were taken from 7 stations from depths ranging from 110 to 341 feet, only 2 of these coming from over 130 feet. One live specimen was washed ashore in September 1949, and 2 others were taken in April and May 1950 by means of baited screen traps lowered through holes in the ice to depths of 80 and 64 feet, respectively.

OTHER MATERIAL EXAMINED: Numerous specimens from localities from Bernard Harbor, Icy Cape, and south to eastern Siberia, Kamchatka, the Pribilofs, the Aleutians, and British Columbia; also from the Grand Banks, Newfoundland, Greenland, and Spitzbergen.

DISCUSSION: Typical *B. tenue* is sculptured by fine, more or less evenly spaced spiral threads that are crossed by fine incremental lines that lend a wavy appearance to the spiral threads and produce an over-all pattern. The sutures are moderately constricted and the whorls moderately convex. Broken or interrupted folds or plications cross the whorls, and in the last whorl they tend to become weaker beyond the periphery. The periostracum is absent as often as it is present; it may be entirely absent in some younger specimens, and may be nearly all retained in some large shells, but more often it is present in patches only (pl. 9, fig. 9).

Instead of becoming weak or obsolete beyond the periphery of the last whorl, in some specimens the longitudinal plications continue strongly to the canal. In some the plications on the spire and body whorl are sparse and weak; in others they are numerous and strong. In some the whorls are much more convex and the sutures much more constricted than in others; this convexity is not associated with number or strength of the axial plications. On the whole, the very large specimens tend toward very convex whorls and constricted sutures. The spiral threads vary in fineness and, although they are never actually grouped into fascicles, one may be unusually close to another, giving the appearance of a missing thread. Some shells may be approximately twice as thick or heavy as others of the same size. The spire may be much longer in proportion to the aperture in some than in others. There seems to be no consistency in these variations as related to locality. One shell from Point Barrow has more inflated whorls and deeper sutures than the others, while another

is slenderer and smoother. However, many shells (of *B. tenue* and other species) from Plover Bay tend to be large and heavy.

The 6 specimens of Dall's variety or subspecies *rhodium* are all from Plover Bay, eastern Siberia. Although these shells are sturdier and much larger than the average *B. tenue*, more specimens may show that they are just a Plover Bay *B. tenue*. Other than that of size, the differences between var. *rhodium* and *B. tenue* (heaviness, prominence of the plications and their continuance to the canal) exist in varying degrees in specimens of *B. tenue*.

DISTRIBUTION: From Bernard Harbor (Northwest Territories), Point Barrow, south to the Aleutians and east to Puget Sound; eastern Siberia, and Kamchatka; the Grand Banks and Newfoundland; western Greenland; Spitzbergen. It is new to Point Barrow.

Buccinum polare Gray, 1839

PLATE 10, FIGURES 1–4

Buccinum polaris J. Gray, 1839, p. 128.
Buccinum polare Martini and Chemnitz, 1883, ed. 2, pl. 9, fig. 4.
Buccinum orotundum Dall, 1907, p. 152.
Buccinum pemphigus orotundum Dall, 1921, p. 99, pl. 12, fig. 9—Oldroyd, 1927, pt. 1, p. 245, pl. 14, fig. 8.

About 9 specimens were collected: During March, April, and May 1950, 5 were taken at depths of 64 and 80 feet by means of baited screen traps lowered to the bottom through holes in the ice; 1 (54 mm. high) was dredged at 80 feet (August 21, 1948); 2 (21 mm. and 26 mm.) at 341 feet; and 1 (30 mm.) at 438 feet. The largest specimen (57 mm. high) came from 80 feet on Mar. 20, 1950.

OTHER MATERIAL EXAMINED: 1 specimen from Bernard Harbor (Northwest Territories), over 100 specimens from localities from Point Barrow south to Nunivak Island, the Pribilofs, and the Aleutians; 20 from Plover Bay and Kamchatka; 1 from Newfoundland; 3 from Spitzbergen.

DISCUSSION: A thin, gray periostracum is present in the living specimens but often begins to flake off when the shell dries. Although the shell is typically thin, there are specimens in which it is fully twice as thick and heavy as in others; it varies from slightly ventricose to decidedly ventricose, and this same variation is evidenced in the whorls. The last whorl is marked by from one to three spiral carinae that usually create a keel, but not necessarily; the carina or carinae may extend apically for from 3 to 5 whorls. In some shells the carinae are scarcely perceptible and there is no keel or angulation. The whorls are covered with spiral threads, which are crossed by the incremental lines, giving a shallowly reticulate appearance. In some shells these spiral threads are much coarser and the resulting sculpture is similar to that of *B. ciliatum* (cf. USNM 213132, 33922, and one

of 33911). There is also variation in the number and strength of the axial plications, some shells having twice as many as others. All possible combinations of these variations are represented in the shells examined.

Examination of the specimens of *B. pemphigus orotundum* in the U. S. National Museum revealed that they are not a variety or subspecies of *B. pemphigus* (Dall, 1921, p. 99) but of *B. polare*. Recourse to the original description of *B. orotundum* Dall (1907, p. 152) further revealed that Dall himself stated that *B. orotundum* is an extremely ventricose form of *B. polare*. Placing var. *orotundum* under *B. pemphigus* apparently was the result of confusing the specific names of *B. polare* and *B. pemphigus*. The type of *B. orotundum* is an exceptionally large and ventricose *B. polare* and there are all gradations between it and typical *B. polare*. The var. *orotundum* has the comparatively small nucleus of *B. polare*, bearing little resemblance to the very broad, blunt nucleus of *B. pemphigus*.

DISTRIBUTION: From Bernard Harbor and Point Barrow south to the Aleutians; also eastern Siberia and Kamchatka.

Buccinum angulosum Gray, 1839

And varieties *normale*, *subcostatum*, and *transliratum* Dall

PLATE 10, FIGURE 10; PLATE 11

Buccinum angulosum Gray, 1839, p. 127, pl. 36, fig. 6.—Oldroyd, 1927, pt. 1, p. 255, pl. 5, figs. 1–3; pl. 17, figs. 9, 10.—Morris, 1952, p. 122, pl. 28, fig. 22 [=var. *subcostatum*].

Buccinum angulosum normale Dall, 1885b, p. 179, pl. 3, fig. 1.—Oldroyd, pt. 1, p. 255, pl. 5, fig. 6.

Baccinum angulosum subcostatum Dall, 1885b, p. 179, pl. 3, fig. 2.

Buccinum angulosum var. *cnismatopleura* Dall, 1919b, p. 328.

Buccinum angulosum var. *transliratum* Dall, 1919b, p. 328.

Buccinum cnismatopleura Dall, 1925, p. 7, pl. 4, fig. 4.

Buccinum angulosum cnismatopleura Oldroyd, 1927, pt. 1, p. 255, pl. 12, fig. 4.

Five specimens of true *B. angulosum* were collected: 2 (48 mm. and 36 mm. high) were washed ashore; 1 (55.5 mm.) was dredged at Eluitkak Pass; 1 (59 mm.) at 522 feet; and 1 was taken on May 17, 1950, at a depth of 64 feet by means of a trap lowered through a hole in the ice.

Twenty-six specimens of var. *subcostatum* were collected: 13 (18.5 to 50 mm.) were taken in screen traps between March 10 and June 13, 1950, at depths of 37 and 64 feet; 9 (12 to 51 mm.) were dredged at Eluitkak Pass (on three different days); and 2 (14 mm. each) were dredged at 110 feet on Sept. 8, 1948.

Sixteen specimens of var. *transliratum* were collected: 13 (36 to 51 mm.) were taken in screen traps between Mar. 20 and June 6, 1950, at depths of 37 to 80 feet; and 1 (51.5 mm.) was dredged at 213 feet.

Eighteen specimens of var. *normale* were collected: 6 (37 to 41.5 mm.) washed ashore in September 1949; and 12 (30.5 to 43.5 mm.) were taken in screen traps between Mar. 10 and June 13, 1950, at a depth of 37 feet.

With the exception of one from 522 feet and one from 213 feet, all 69 of these specimens came from depths of 110 feet or less, and 39 were taken in winter by means of screen traps. The shells were frequently partially covered with hydroids.

OTHER MATERIAL EXAMINED: About 17 specimens of *B. angulosum* from Bernard Harbor, Point Barrow, Icy Cape, and Kotzebue Sound; 2 from Spitzbergen.

Four specimens of var. *subcostatum*, including the figured type, from Point Barrow, Station 24, Canadian Arctic Expedition, and Icy Cape.

About 15 specimens, including the type, of var. *transliratum* from localities from Point Barrow to Unimak Island in the Aleutians.

Over 100 specimens, including the type lot, of var. *normale* from localities from Bernard Harbor to Point Barrow, to Kotzebue Sound; 1 from eastern Greenland; 1 from Spitzbergen.

DISCUSSION: In both true *B. angulosum* and var. *normale* there are fine to medium-fine spiral threads that are crossed by about equally strong incremental lines that give the surface a wavy or shallowly reticulate appearance. In the forms of var. *subcostatum* and var. *transliratum* there is more of a tendency toward fasciculation of the fine spiral threads and the incremental lines are not so prominent as in the above two forms, but they are quite evident and exert enough influence to produce a wavy effect and make lines across the shallow interspaces.

But if one examines a sufficient number of shells, it is possible to find almost every intergradation between the two types of sculpture. In some shells of the *transliratum* variety the spiral lines are nearly evenly spaced and there is little evidence of an interspace. It is also possible to find shells with both types of sculpture on the same shell. And in some shells of the *B. angulosum* type the sculpturing approaches that of *B. ciliatum*, with a heavier spiral cord alternating with a weaker one and with the incremental lines no stronger than the weaker spiral cord, or perhaps not so strong.

One specimen that was assigned to var. *transliratum* has a much heavier than typical shell with a flaring lip—both characteristics suggesting *B. angulosum;* it has two spiral carinae that suggest var. *transliratum* (the anterior carina is weaker than the posterior one and the shell is slightly nodulous at the junction of the posterior carina and the ribs); the sculpture is that of var. *transliratum*. Four shells that were assigned to var. *subcostatum* have discrepancies that make

them doubtful, and there are two that are even more questionable. There is one very questionable var. *normale*, and several others that could as easily be assigned to one form as the other.

Plate 11 depicts *B. angulosum* and its varieties. Figure 7 of plate 11 is of a small *B. angulosum* with the typical few but prominent longitudinal ribs, a strong carina, and an angle about midway of the last whorl. In figure 6 the ribs are strong, the carina is only a suggestion, and the angle is slight. In figure 5 there is no carina, no angle, and the ribs are much less prominent. In figure 4, which is midway in shape between figures 5 and 6, there is no carina, and the ribs are similar to those in figure 5. Specimens shown in figures 4 and 5 would be classed as var. *subcostatum*, but figure 6 is midway between the typical *B. angulosum* and var. *subcostatum*.

Although it has only three strong cords and a very weak fourth (the type has four and a weak fifth), the specimen in figure 11 could be placed in var. *transliratum* without question. The specimen in figure 12 has two strong cords and a weaker third, and the ribs are stronger than in figure 11. The specimen shown in figure 13 has strong ribs and only one spiral cord and is intermediate between *B. angulosum* and var. *transliratum*.

The specimens in figures 1 and 2 could be placed in var. *normale* without hesitation. Figure 3 is of a var. *normale* with flatter whorls and a less flaring mouth; the apparent longitudinal ribbing is abnormal—the result of injuries.

The specimen in figure 8 is midway between var. *normale* and var. *subcostatum*, having a somewhat flared mouth like var. *normale* and weak ribs as in var. *subcostatum*. Its one cord, even though weak, allies it with *B. angulosum*. The specimen in figure 9 has two fairly strong cords, almost no ribbing on the last whorl, and no angle, while the one in figure 10 has the heavier shell of *B. angulosum*, the flaring outer lip of var. *normale*, ribs more like those of var. *subcostatum*, and two cords that suggest relationship with var. *transliratum*.

After examining hundreds of specimens of this species and its varieties, I believe that the subspecies *subcostatum*, *transliratum*, and *normale* are only forms of *B. angulosum*. Certainly there is no more variation in all these forms than there is in those of *Thais lamellosa*, in which it has generally been conceded that the subspecies should be dropped.

The only two existing specimens of *B. angulosum cnismatopleurum* Dall are pathological ones. The type specimen had been injured several times, had made repairs, and continued growing. The resulting shell is a squat form that is heavier and has more prominent ribs than typical forms of var. *transliratum*. The second specimen, from between Cape Beaufort and Cape Lisburne, is also a var.

transliratum that suffered no less than three major injuries. The shell, which seems slightly heavier than the average var. *transliratum*, is a much-worn specimen in which the cords are lacking. *B. cnismatopleurum* is not a valid varietal name, much less a subspecific one.

DISTRIBUTION: *B. angulosum:* Bernard Harbor and Point Barrow to Kotzebue Sound; also Spitzbergen. Var. *subcostatum:* Point Barrow to Icy Cape. Var. *transliratum:* Point Barrow south to Bristol Bay and Unimak Island in the Aleutians. Var. *normale:* Bernard Harbor and Point Barrow south to Kotzebue Sound; also eastern Greenland and Spitzbergen.

Buccinum fringillum Dall, 1877

PLATE 10, FIGURES 6, 7

Buccinum fringillum Dall, 1877, p. 4.[8]—Martini and Chemnitz, 1883, ed. 2, vol. 3, abt. 1c, p. 88, pl. 91, fig. 9.—Oldroyd, 1927, pt. 1, p. 256.

Two live specimens were taken on Oct. 11, 1949, at a depth of 453 feet. Including the 2 whorls of the nucleus, the larger of the 2 specimens has 7 whorls, the smaller 6.5. Both are covered with periostracum (heavier and coarser in the larger specimen) that projects from the surface in heavily fringed axial folds. The larger shell is 37.7 mm. high by 24.6 mm. in diameter; the smaller, 28 by 20.5 mm. Small barnacles, small colonies of bryozoans, and foraminifers were growing on the periostracum.

OTHER MATERIAL EXAMINED: The type and 7 other specimens from the north end of Nunivak Island.

DISCUSSION: *B. fringillum* is more closely allied to *B. ciliatum* than any of the other species of *Buccinum* from Point Barrow, but the shell is thinner and much more inflated, the periostracum is markedly more fringed, and the sculpture is finer than that of *B. ciliatum*. (The type locality is the north end of Nunivak Island in Bering Sea, not "Arctic Ocean near Icy Cape," as given by Oldroyd.)

DISTRIBUTION: Point Barrow, and the north end of Nunivak Island at 54 feet. The Point Barrow specimens represent an extension of distribution in depth and a northerly extension in range from about the 60th to the 71st parallel of latitude.

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[8] Dall (1921, p. 101) gives the following reference for *Buccinum fringillum* Dall, 1877· Proc. Calif. Acad. Sci.. vol. 7, p. 9. Vol. 7, pt. 1, ser. 1, of the official proceedings of the Academy, covering the meetings of 1876, was published in 1877. *Buccinum fringillum* is not mentioned in pt. 1 of vol. 7 and there is no pt. 2, for the Academy did not begin publishing the second series of the Proceedings until 1888. Thus a period of 11 years elapsed during which no official proceedings were published. It is probable that Dall expected his paper to be published by the Academy, for the separate that was published followed the format of the Proceedings. The page number is more difficult to explain, for the separate (see "References") containing the description is paged from 1 to 6, and *B. fringillum* is described on p. 4.

Buccinum ciliatum Fabricius, 1780

PLATE 10, FIGURES 8, 9

Tritonium ciliatum Fabricius (not Gould), 1780, p. 401.
Buccinum ciliatum Tryon and Pilsbry, 1879–1898.—Martini and Chemnitz, 1883, ed. 2, vol. 3, abt. 1c, p. 29, pl. 78, figs. 5, 6.

Six living specimens were taken from 8 stations ranging in depth from 162 to 741 feet. The shells range from 15.5 mm. in height by 9 mm. in diameter (341 feet) to 33.5 by 19 mm. (420 feet). Three empty shells were also found.

OTHER MATERIAL EXAMINED: 17 specimens from localities ranging from Point Barrow (1 dead specimen) to Plover Bay, the north end of Nunivak Island, and the Pribilofs; 1 specimen from the northeast part of the Grand Banks, 1 from the southeast coast of Newfoundland, 1 from Murray Bay, Quebec; 12 from Greenland; 1 from Spitzbergen.

DISCUSSION: In slender specimens the aperture is shorter than the remainder of the shell but in more squat specimens the aperture is the longer. The specimens from Point Barrow range from slender to squat. They are covered with a tan, hirsute periostracum that is often worn off on the outer margins of the ribs. The specimen from 420 feet is tumid, with at least 17 ribs; a smaller one (29.5 by 16.5 mm.) from 341 feet has about 19 ribs on the last whorl. Specimens examined from Plover Bay tend to be somewhat squat, with the aperture longer than the remainder of the shell.

The spiral sculpture varies from wide, flattish bands to prominent ridges, with a thread in each interspace. Specimens examined from Greenland were characterized by flatter, less pronounced spiral sculpturing than the Point Barrow ones. About half of the Greenland shells were nearly twice as heavy as the others of comparable size.

DISTRIBUTION: The localities mentioned above and, in addition, the following: North of the mouth of the Mackenzie River, Baffin Land, Labrador; Jan Mayan, Beeren Island, Novaya Zemlya; the White Sea, the Murman Coast, the Siberian Arctic (Thorson, 1944). Dall (1921) gives the Pacific range as "Point Barrow, Arctic Ocean, south to the Aleutian Islands and eastward to the Shumagins." The specimen from the Shumagins is a small, dead, eroded shell that does not look like *B. ciliatum*. The most southerly specimen that I examined came from off the Pribilofs. The present specimens are the first living ones from Point Barrow and the second record from north of Bering Strait.

Buccinum undatum (Linnaeus, 1761)

Var. *striatum* Pennant

PLATE 10, FIGURE 5

Buccinum undatum Linnaeus, 1758, p. 740; 1767, p. 1204.
Buccinum undatum Linnaeus var. *striatum* Pennant, 1812, vol. 4, p. 272.

A single living specimen, measuring 24.8 by 14.6 mm., was dredged at a depth of 477 feet on Sept. 6, 1949.

DISCUSSION: This specimen does not conform with any species that I have seen. Dr. W. J. Clench (personal communication) considers it very close to the var. *striatum* of *B. undatum*. It is a young shell with a thin gray periostracum with delicate axial folds beset with hairs much as in *B. ciliatum*. The spiral sculpture is also suggestive of *B. ciliatum* in that heavier axial threads alternate with smaller ones, and there is also a little of the wavy effect characteristic of *B. angulosum*. However, the general structure of the shell rules out *B. ciliatum*, for it is larger in diameter in proportion to the length; the aperture is longer in proportion to the remainder of the shell, the canal is not reflexed, the whorls are more tumid and enlarge more rapidly, and the entire shell is much thinner and lacks the sturdiness of *B. ciliatum*. On the last whorl there are about 22 axial ribs that evanesce at the periphery, and the next to the last whorl has about the same number, that become increasingly faint toward the apex.

DISTRIBUTION: *B. undatum* has been recorded from Labrador to New Jersey and from Europe; the var. *striatum* has been recorded from off Labrador from 60 to 80 fathoms.

Genus *Pyrulofusus* Mörch, 1869

Pyrulofusus deformis (Reeve, 1847)

PLATE 13, FIGURES 3–5

Fusus deformis Reeve, 1847, vol. 4, *Fusus*, pl. 12, figs. 45a–b.
Pyrulofusus deformis Dall, 1921, p. 89.—Oldroyd, 1927, pt. 1, p. 184.

Two living and 2 dead specimens of this species, the largest snail taken at Point Barrow, were collected: The smallest, consisting of about 2.5 nuclear and one postnuclear whorl, and which measures 35.9 mm. high by 19.6 mm. in diameter, was taken at a depth of 438 feet; the largest (142 by 83 mm.) was dredged at 130 feet (Sept. 15, 1948); the 2 dead specimens (72.4 by 28.2 mm. and 83.5 by 42 mm.) were taken from 453 feet and 120 feet (Sept. 15, 1948), respectively. Approximately one fourth of the surface of the largest shell (pl. 13, fig. 5), a live specimen, was covered with colonies of encrusting bryozoans of at least three different species, and several small barnacles were also attached to it. Even the smallest shell (pl. 13, fig. 3), also

a live specimen, had one barnacle and a few cells of bryozoan colonies growing on it.

Other material examined: About 25 specimens from localities ranging from Icy Cape (one dead shell from the beach) to the Pribilofs, the Aleutians, and southeast of the Aleutians.

Discussion: This species exhibits variations in the prominence of the obliquely longitudinal ribs and in the character of the sculpturing. Small specimens show spiral threads that are given a wavy effect by the incremental lines. The spiral threads vary in coarseness, and in some shells they may be grouped; in the larger specimens the shells are often too worn to show the sculpturing, but in some there are several irregularly spaced spiral cords on the last whorl.

Distribution: Point Barrow to around Unimak Island in the Aleutians; also Spitzbergen. The only reference to a living shell north of the Arctic Circle appears to be that of the type from Spitzbergen. The Point Barrow specimens represent a new locality record and the first living specimens from Arctic Alaska.

Genus *Beringius* Dall, 1894

Beringius stimpsoni (Gould, 1860)

And var. *malleatus* Dall

Plate 13, figures 1, 2

Buccinum stimpsoni Gould, 1860, p. 325.
Strombella malleata Dall, 1885a, p. 525.
Beringius malleatus Dall, 1925, p. 5, pl. 6, fig. 5.—Oldroyd, 1927, pt. 1, p. 195, pl. 22, fig. 5.
Beringius stimpsoni Dall, 1925, p. 6, pl. 7, fig. 2.—Oldroyd, 1927, pt. 1, p. 195, pl. 21, fig. 2.

One dead and 5 living specimens were collected: the largest, the dead shell (107 mm. in height by 53.8 mm. in diameter, and foreshortened by breakage at both ends), was taken at 125 feet; 1 (12.7 mm. in height) at 162 feet; 2 (44.7 mm. and 48.4 mm.) at 453 feet; and 2 (60.4 mm. and 64.6 mm.) at 522 feet. One of the shells had been broken and repaired several times. Although even the living shells are worn and encrusted, fine spiral lines are visible.

Other material examined: Nine specimens labeled *B. malleatus* and a few *B. stimpsoni* from localities ranging from Point Barrow (1 beach specimen) to the Pribilofs.

Discussion: When Gould wrote the original description of *B. stimpsoni,* he did not figure the species. Later Dall (1925) selected a specimen to represent the type, and his figure of it (pl. 7, fig. 2) is the same figure as appears in Oldroyd (1927, pt. 1, pl. 21, fig. 2). Unfortunately, in the text of his paper Dall confused the museum

numbers of the shells, stating that USNM 40979 is the type of *B. malleatus* and this number was cataloged as the type. Actually, the shell that he figured is USNM 15170. The shell labeled the type is a 7-sided form similar to the figure of *B. stimpsoni* in Oldroyd (1927, pt. 1, pl. 21, fig. 2).

I believe that *B. malleatus* is only a variety of *B. stimpsoni*. In his original description of *B. stimpsoni*, Gould wrote: "shell large, solid, elongate, . . . whorls 6 to 8+, pyramidal, pentagonal, the last anteriorly excavated, at which place the spiral ribs terminate in a wave (carina)." Examination of many specimens reveals that the shells may be from 5-sided to 7-sided.

In his original description of *B. malleatus*, Dall compares it with *Beringius beringi* (Middendorff), stating that the shell is "long and slender," has "few large (generally only five) transverse ribs, between which the space is nearly flat rather than concave, and a sharp carina on the anterior periphery of the last whorl, on which the suture is laid."

Examination of specimens of both *B. stimpsoni* and var. *malleatus* shows that the fewer the ribs the flatter the surface between them, but there is always a certain amount of excavation even in shells with the fewest number of sides (see pl. 13, fig. 1). This excavation is evident also in the figure by Oldroyd (1927, pl. 22, fig. 5). Dall speaks of a dark purple color in connection with *B. malleatus*, but examination shows that some specimens are brown and others are nearly ash colored. Gould speaks of an ash-colored or pale rust shell, with pale ash-colored or leaden-colored throat in *B. stimpsoni*.

The dead specimen mentioned above from 125 feet is very similar to that figured by Dall for the type specimen of *B. malleatus* except that in the latter there is no carina on the last whorl, the ribs simply terminating at the periphery. In the shell from the MacGinitie collection there is a definite carina at the termination of the ribs and the shell is somewhat excavated both anteriorly and posteriorly (between the ribs) to it (see pl. 13, fig. 1). In both shells the last whorl is 5-sided. In the MacGinitie shell the penultimate whorl is only 4-sided, lending a definite squarish appearance to the shell, but even on this whorl the space between the ribs is not exactly flat. One of the postnuclear whorls is 6-sided. The shell is heavy and brown, with at least 7 whorls. It can be referred to *B. stimpsoni* var. *malleatus*.

The 60.4 mm. specimen from 522 feet has 6 sides on the last whorl and 7 on the penultimate whorl, and the space between the ribs, or "waves," is concave (pl. 13, fig. 2). There are 5.5 whorls, including the nucleus. The shell is ash colored, but reddish brown where worn, and the throat is a leaden brown. The spiral sculpturing is the same

as that of the shell above and, except for the carina at the periphery of the last whorl, the same as that of Dall's type of *B. malleatus*. This shell can be referred to *B. stimpsoni* var. *stimpsoni*.

The specimens in the U. S. National Museum vary in the number of sides, in the presence or absence of a carina at the periphery, in color, and in the degree of concavity between the ribs. Depending on the age of the shell, there are from 2 to 4, more or less flattened, spiral cords posterior to the carina or periphery of the last whorl. In some shells (especially in young specimens) the aperture is longer than the remainder of the shell.

DISTRIBUTION: From Point Barrow to the Pribilofs. Living specimens have not been reported previously from Point Barrow.

***Beringius beringi* (Middendorff, 1849)**

And var. *kobelti* Dall

PLATE 12, FIGURES 1–6

Tritonium (*Fusus*) *behringii* Middendorff, 1849a, p. 243; 1849c, pt. 2, p. 147 pl. 3, figs. 5, 6; 1849d, pt. 2, p. 476, pl. 3, figs. 5, 6.
Volutopsius (*beringii* Midd. var.?) *kobelti* Dall, 1902, p. 528, pl. 35, fig. 2.
Volutopsius beringi Dall, 1921, p. 89.—Oldroyd, 1927, pt. 1, p. 186.
Volutopsius beringi kobelti Dall, 1921, p. 89.—Oldroyd, 1927, pt. 1, p. 187, pl. 23, fig. 2.

Eleven living specimens were dredged at 9 stations: 1 (49.2 mm. high) at 40 feet at Eluitkak Pass on Aug. 10, 1948; 1 (25 mm. high) at 120 feet on Aug. 8, 1949; 1 (20 mm.) at 152 feet; 2 (29.2 mm. and 32.7 mm.) at 184 feet; 3 (38.8 mm., 45.7 mm., and 64.8 mm.—the largest living one collected) at 216 feet; 1 (10.8 mm.) at 217 feet; and 2 (24.6 mm. and 45.2 mm.) at 522 feet. Several dead shells ranging from 21.4 to 73 mm. in height were taken from depths of 80 to 453 feet. The one dead shell from 80 feet was inhabited by a hermit crab *Pagurus trigonocheirus*. Another dead shell, apparently a typical *B. beringi*, from 453 feet measures 123 mm. in height even without the missing nucleus; it is about 64 mm. in diameter. Even in the living shells, the whorls of the spire are eroded and the periostracum is missing, but the major portion of the last whorl is covered by a thin, straw-colored periostracum.

OTHER MATERIAL EXAMINED: Over 40 specimens (under the name of *Volutopsius beringi kobelti* Dall) from localities ranging from Icy Cape to the Shumagins.

DISCUSSION: I did not have access to the type of *B. beringi*, which is in the Academy of St. Petersburg, but study of the literature and of at least 50 specimens convinces me that *V. kobelti* Dall (1902) is only a variety of *B. beringi*. About one-third of the specimens labeled *V. kobelti* in the U. S. National Museum are undoubtedly

B. beringi, but there is so much variation, with all types of intergradations between the typical and the var. *kobelti*, that it is impossible to separate some of them. (Middendorff named his species after the explorer Bering. Under the impression that the latter's name was spelled with an "h," he originally wrote *T. Behringii* but later changed it to *T. Beringii* and in a footnote (1851, p. 224) explained that he had learned Bering spelled his name without an "h.")

Typically, var. *kobelti* has a thinner shell, longer spire, shorter aperture, and more curved canal than *B. beringi*. Also, var. *kobelti* has a tendency toward 7 definite sides (pl. 12, fig. 6), whereas *B. beringi* is not so angular (pl. 12, fig. 1) and the last whorl is more tumid than in var. *kobelti*.

The specimens from Point Barrow include typical *B. beringi*, typical var. *kobelti*, and every possible combination of characteristics in between. Some are seven-sided, others six-sided; some have prominent ribs and concave sides; others have obsolete ribs and convex sides; while in others the sides are almost flat. Dall's original description states: "The axial waves (they can hardly be called ribs) of *V. kobelti* are feeble and irregular. . . ." Whether waves or ribs, they are certainly not feeble in some of the specimens. In some the spire is long and slender, with whorls increasing gradually in size; in others it is short and the whorls increase rapidly (pl. 12, fig. 3). In some shells the aperture is longer than the remainder of the shell (pl. 12, fig. 3); in others it is shorter; and in still others the aperture and the remainder of the shell are about equally long.

The variations in the nucleus are remarkable (pl. 12, cf. fig. 4 with figs. 5, 6): In some shells the nuclear whorls number only about 1.75, while in others there are more than 3 whorls; the diameter of these nuclear whorls varies from relatively small to very large; the whorls may increase rapidly in size or, in a nucleus of about 3 whorls, they may all be approximately the same diameter. The length of the nuclear whorls varies as much as the diameter and as much as the length of the postnuclear whorls.

In a specimen from Eluitkak Pass the spire is short (19 mm.), the aperture long (30 mm.); there are two small, short, nuclear whorls, and the postnuclear whorls are short and tumid. Most of these characteristics are like those of *B. beringi*, but the shell is thin, as in var. *kobelti*. In a shell from 341 feet the aperture is 15 mm. long, the remainder of the shell 15.5 mm., the 2.5 nuclear whorls are slightly tapered (the first whorl being 5 mm. in diameter, the next, 6 mm.), and the postnuclear whorls increase gradually in size. In still another shell (medium thin) from 522 feet, the aperture is 22 mm., the remainder of the shell is 23.5 mm., the 3+ nuclear whorls are very large and long and are approximately equal in diameter; the first

postnuclear whorl increases very little, the next slightly more, and the next still more, but the increase is not rapid.

Spiral lirations, varying from faint to strong, are present on the last whorl and sometimes on earlier whorls. The large empty shell from 453 feet (pl. 12, fig. 1), which conforms with the type of *B. beringi* figured by Middendorff (1849c and 1949d, pt. 2, figs. 5, 6), has been tunneled by other animals and is practically covered with colonies of bryozoans, but in one bare spot four faint lirations are visible on the last whorl and at least two on the next to the last whorl. Without the nucleus, this shell has about 5.5 moderately convex whorls, the last increasing more rapidly than the others, with 9 longitudinal waves on the next to the last whorl. I believe that only in young specimens or specimens that have been *worn* smooth would Dall's statement that "*V. beringi* is absolutely smooth, except at the canal," hold true. Often specimens of var. *kobelti* have lirations as faint as those of true *B. beringi*.

The thin, straw-colored to olive-tan periostracum sometimes covers practically the entire shell, sometimes it is lacking entirely, but more often, even in immature specimens, it is present in patches, the last whorl usually being more thoroughly covered than the others.

Distribution: Point Barrow to Nunivak Island and the Shumagins. The var. *kobelti* is new to Arctic Alaska. Four specimens of var. *kobelti* from the beach near Icy Cape and a juvenile from between Cape Lisburne and Cape Beaufort have apparently not been recorded in the literature; nor, apparently, have two young specimens of *B. beringi* from the Shumagins, a large one from Pavlov Bay, and a large shell from the beach at Point Barrow.

Genus *Colus* Röding, 1798

Colus spitzbergensis (Reeve, 1855)

Fusus spitzbergensis Reeve, 1855, p. 395, pl. 32, fig. 6.
Colus spitsbergensis Oldroyd, 1927, pt. 1, p. 212, pl. 4, fig. 7.
Colus spitzbergensis Morris, 1947, p. 153, pl. 36, fig. 8; 1951, p. 202, pl. 36, fig. 8; 1952, p. 126, pl. 29, fig. 5.—Abbott, 1954, p. 229, fig. 51h.

Eleven specimens, at least 9 of which were living, were collected: 2 from 125 feet, 1 from 152 feet, 1 from 217 feet, 1 from 341 feet, 2 from 420 feet, 2 from 438 feet, and 1 from 522 feet. The largest, from 522 feet, measures 64.7 mm. in height by 29.2 mm. in diameter; the smallest, from 217 feet, is 11.7 mm. in height.

The periostracum of the posterior whorls of these shells is largely worn off and often the cords are partially eroded away. The grooves between the cords are usually occupied by several species of foraminifers, bryozoans, and young barnacles.

OTHER MATERIAL EXAMINED: About 10 specimens from Labrador, the Grand Banks, Greenland, the Gulf of St. Lawrence, and Egg Harbor, Maine; about 50 specimens from localities ranging from Icy Cape, Bering Island, the Pribilofs, the Aleutians, and northern Japan.

DISCUSSION: There are variations in the length of the aperture and canal in relation to the length of the spire, in the convexity of the whorls, in the degree of flaring of the mouth, in the thickness of the shell, and in the width of the interspaces as compared with the spiral ridges. One specimen from the Chamisso Islands, Kotzebue Sound, is very slender; in several from Bering Island the whorls are unusually convex; in one from the Shumagins the interspaces are wide; three from off Cape Seniavine have heavy shells, and in two of these the whorls are unusually tumid; and one from the Grand Banks has a longer aperture and canal than usual.

DISTRIBUTION: Point Barrow to Juan de Fuca Strait, Washington; northern Japan; Labrador to Egg Harbor, Maine.

Colus capponius Dall, 1919

Colus capponius Dall, 1919b, p. 317; 1925, p. 12, pl. 3, fig. 2.—Oldroyd, 1927, pt. 1, p. 217, pl. 9, fig. 2.

One shell, measuring 43.5 mm. high by 27.5 mm. in diameter, was taken on Oct. 11, 1949, at a depth of 341 feet, from a bottom of rocks and stones and a small amount of gravel. Although this was an empty shell, it had been alive quite recently. Several species of bryozoan colonies and some foraminifers were growing on the shell. In patches over the shell and over the entire surface of the apical whorls, the periostracum and outer layer of the shell were worn off.

OTHER MATERIAL EXAMINED: Several specimens from Point Barrow and Bering Strait.

DISTRIBUTION: Point Barrow and Bering Strait. It has not been reported previously from any locality except near Port Clarence, Bering Strait.

Colus martensi (Krause, 1885)

Sipho martensi Krause, 1885b, p. 287, pl. 18, fig. 18.
Colus martensi Oldroyd, 1927, pt. 1, p. 222, pl. 28, fig. 6.

On Aug. 10, 1948, a recently dead shell was dredged at 40 feet at Eluitkak Pass to Elson Lagoon, on a bottom predominantly stony, with some mud. The shell, which was occupied by a hermit crab, *Pagurus trigonocheirus*, measures 46 mm. high by 18.5 mm. in diameter, but both ends and the lip are somewhat broken. The shell is medium brown and, like many of the Arctic shells, shows the marks of more than one injury to the lip as it was growing.

OTHER MATERIAL EXAMINED: A few specimens from Cape Shelagskoi (70th parallel), Metschigne Bay, Bering Strait, and Plover Bay.

DISTRIBUTION: Point Barrow to Plover Bay. It has not been reported previously from north of Bering Strait.

Genus *Neptunea* Röding, 1798

Neptunea ventricosa (Gmelin, 1790)

PLATE 14, FIGURES 1–6

Buccinum saturum Martyn, 1784, pl. 2, fig. 47. [Not binomial.]
Buccinum ventricosum Gmelin, 1790, p. 3498.
?*Chrysodomus variciferus* Dall, 1907, p. 154.
Chrysodomus saturus Dall, 1921, p. 97.—Oldroyd, 1927, pt. 1, p. 232, pl. 27, figs. 3, 4.
?*Chrysodomus solutus variciferus* Dall, 1921, p. 97, pl. 9, figs. 6, 7.
Neptunea ventricosa Abbott, 1954, p. 230, pl. 24s.

Fifteen living specimens were dredged: 1 (48.5 mm. high by 28 mm. in diameter) at 110 feet; 1 (68.5 by 41 mm.) at 120 feet; 1 (16.5 by 10 mm.) at 138 feet; 1 (61.5 by 36.5 mm.) at 125 feet; 3 (21, 25, and 29 mm. high) at 152 feet; 2 (41 and 59 mm.) at 341 feet; 3 (about 79 by 46, 83 by 47, and 83.5 by 44.5 mm.) at 420 feet; 2 (61 mm. and about 78 mm.) at 453 feet; and 1 (24 by 14 mm.) at 522 feet. Several broken and barnacle-encrusted shells inhabited by hermit crabs were taken at 120, 130, and 420 feet. More often than not, the nucleus of a large living shell would be broken off.

OTHER MATERIAL EXAMINED: Numerous specimens from localities ranging from Cape Smythe (Point Barrow), Alaska, to the northern end of Nunivak Island.

DISCUSSION: In some of the shells of this species the whorls are practically flat (pl. 14, fig. 1), in others there is a slight convexity (pl. 14, fig. 5); in most of the shells 2 cords, or carinae, follow the whorls (pl. 14, figs. 1, 6), but in some the more posterior of the two is not marked; in some the last whorl is somewhat lamellose (pl. 14, fig. 3), in others not, and in still others axial ribs (pl. 14, fig. 5) occur at the points of growth cessation. In some of these shells there is only a slight tendency toward nodes, in others there are decided nodes, especially on the more anterior of the 2 carinae. Except in the smallest shells, the outer lip is not angled at the carina. The canal is decidedly curved and reflexed. The color varies from an ashen white to a light brown, sometimes with a combination of colors in the same shell. The carinae are usually darker than the remainder of the shell and the nodes may be still darker or almost white. The throat varies from almost white to purplish brown. In young shells and well-preserved older specimens, the nucleus is markedly conspicuous; it consists of 2 complete whorls, is pure white, large, cylindrical, and blunt. The contrasting color and cylindrical shape cause the nucleus to resemble a plug inserted into the shell.

In 1907 Dall described a *Chrysodomus variciferus*, which was characterized by having "about seven sharp, thin, very prominent varices" on the last whorl. In 1921 he listed this same species as *Chrysodomus solutus variciferus*. Since Hermann (1781) devotes the greater portion of his description of *Buccinum solutum* to stressing the varices of his species (although they were irregularly spaced rather than evenly spaced as in Dall's species), it is difficult to understand why Dall assigned a form with varices to a subspecies of *N. soluta*, the chief characteristic of which was its varices. One can only suppose that he confused *N. soluta* and *N. satura* and intended making *varicifera* a subspecies of *N. satura*. This is equally difficult to understand, for it is well known that specimens of *N. "satura"* are often lamellose. (See remarks under *Neptunea middendorffiana*.)

DISTRIBUTION: Point Barrow southwest to Bering Strait, and Plover Bay, Siberia, southeast to Cape Douglas (about lat. 65° N., long. 167° W.), Alaska.

Neptunea heros (Gray, 1850)

PLATE 15

Tritonium (*Fusus*) *antiquum* var. *communis obsoletior*,[9] forma *normalis* Middendorff, 1849d, pt. 2, p. 461 (=p. 132 of 1849c), pl. 2, figs. 1, 2; 1851, vol. 2, pt. 1, p. 228, pl. 9, figs. 1, 2.

Tritonium (*Fusus*) *antiquum* var. *communis insignior* Middendorff, 1849d, pt. 2, p. 462 (=p. 133 of 1849c), pl. 5, figs. 3–6 (figs. 3, 4 are of younger specimens).

Tritonium (*Fusus*) *antiquum* var. *communis obsoletior* forma *normalis*, *apertura alta* Middendorff, 1851, vol. 2, pt. 1, p. 228, pl. 9, figs. 3, 4.

Tritonium (*Fusus*) *antiquum* var. *communis insignior* forma *elatior* Middendorff, 1851, vol. 2, pt. 1, p. 228, pl. 8, fig. 1.

Tritonium (*Fusus*) *antiquum* var. *communis insignior* forma *normalis* Middendorff, 1851, vol. 2, pt. 1, pl. 8, fig. 2.

Chrysodomus heros J. Gray, 1850, p. 15, pl. 7.

Fusus fornicatus Reeve, 1843–1878, vol. 4, *Fusus*, pl. 16, fig. 63.

Chrysodomus saturus communis Dall, 1921, p. 97.—Oldroyd, 1927, pt. 1, p. 235.

Chrysodomus solutus Dall, 1921, p. 97 (in part).

Eleven living specimens were dredged: 3 (47 by 28 mm., 77 by 45.5 mm., and 96 by 52 mm.) at Eluitkak Pass; 2 (24 and 27 mm. in height) at 120 feet; 1 (73 by 46.5 mm.) at 130 feet; 1 (74.5 by 45 mm.) at 138 feet; 2 (64 by 35 mm. and 106 by 55.5 mm.) at 522 feet; and 2 (89 by 48 mm. and 100 by 54 mm.) at 741 feet. Eleven often badly broken and barnacle-encrusted shells, usually inhabited by hermit crabs, were dredged at 152, 184, 295, 341, 438, 741 feet, and at Eluitkak Pass.

OTHER MATERIAL EXAMINED: Specimens in the collection of the U. S. National Museum from localities ranging from Point Barrow to Siberia and to Nunivak Island and the Pribilofs.

[9] Middendorff (1851b, p. 226) calls attention to a printer's error on page 131, line 23, of his "Beitrage" [1849c—equals p. 460, 1849d], in which "*communis elatior*" appeared instead of "*communis obsoletior*."

Discussion: Middendorff (1849c,d) described several species of *Neptunea* as sub-subvarieties of *Tritonium antiquum*. His polynomial system is outlined below:

Tritonium antiquum Linnaeus
Section I. Non carinate, without nodes.
1. Var. *originalis* nob.
2. Var. *behringiana* nob. [Middendorff's pl. 2, figs. 3, 4; pl. 5, fig. 1]
Section II. Carinate.
3. Var. *communis* nob.
1) Var. *communis obsoletior*
forma *normalis* [Middendorff's pl. 2, figs. 1, 2]
forma *elatior* [Middendorff's pl. 5, fig. 2]
forma *normalis*
forma *normalis, apertura alta* [Middendorff's pl. 2, figs. 1, 2]
2) Var. *communis insignior* [Middendorff's pl. 5, figs. 5, 6]
3) Var. *angulato-carinata*

Like the buccinums, the neptuneas are extremely variable, so variable as to make the separation of specimens into species discouragingly difficult. Middendorff's polynomial system was no doubt the result of an attempt to give names to these varied forms.

As J. E. Gray (1850) was apparently the first person after Middendorff to describe this species, I am using his name for it.

Although in his reference for *Chrysodomus saturus communis* Middendorff, Dall (1921) designates the correct figures (pl. 5, figs. 5, 6 of Middendorff, 1849c,d), he apparently later confused *N. satura* and *N. soluta*, for he included shells of *Neptunea heros* under the label of "*Chrysodomus solutus* Hermann" (see *Neptunea middendorffiana* below).

The shell of *Neptunea heros*, consisting of 5 whorls plus about 2 nuclear whorls, is sturdy, varying in color from ashen to tan and the latter color may tend toward a rosy cast or toward an olive tan. The throat is usually white but in some specimens the white coating is too thin to conceal the tan of the shell. The majority of the shells (pl. 15) tend to be less ventricose than those of *N. ventricosa* (pl. 14, figs. 1–6) and more ventricose than those of *N. middendorffiana* (pl. 14, figs. 7–10). The canal is longer and less curved than that of *N. ventricosa*, and tends to be somewhat more curved than in the majority of *N. middendorffiana*. Although in all three species there is a tendency toward the formation of longitudinal ridges and varices at the points of growth cessation, this tendency appears to be less marked in *N. heros* than in *N. ventricosa*. The single carina or cord that follows the whorls is usually noded. In the long-spired forms this cord is situated about the middle of the whorl (pl. 15, fig. 1) but in the short-spired forms it is closer to the anterior end of the whorl (pl. 15, fig. 2). The nodes may project prominently or may be

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elongated (pl. 15, fig. 2) and the cord may practically disappear on the last portion of the last whorl, its location being indicated only by a slight shouldering and by the nodes (pl. 15, fig. 7). An unusually slender form with a very weak carina and without nodes is shown in pl. 15, fig. 4. In the shortest-spired forms the aperture may be nearly twice as long as the remainder of the shell (pl. 15, fig. 2). In contrast to the nucleus of *N. ventricosa* and of *N. middendorffiana*, that of *N. heros* is small and tapered.

DISTRIBUTION: MacKenzie River delta west and south to Bristol Bay in the Bering Sea. Point Barrow is a new locality.

***Neptunea middendorffiana*, new name**

PLATE 14, FIGURES 7–10

Tritonium (*Fusus*) *antiquum* var. *communis obsoletior* forma *elatior* Middendorff, 1849d, pt. 2, p. 461, pl. 5, fig. 2.

Chrysodomus solutus Dall, 1907, p. 154 (in part).—Oldroyd, 1927, pt. 1, p. 236 (in part). (Not *Buccinum solutum* Hermann, 1781, pp. 52, 53, pl. 2. figs. 3, 4.)

Neptunea despecta Y. Hirase, 1907, p. 360 (in part). (Not *Murex despectus* Linnaeus, 1758.)

Neptunea vinosa (Dall), var., Kinoshita and Ishaya, 1934, p. 9, pl. 6, fig. 43. (Not *Chrysodomus vinosus* Dall, 1919.)

Neptunea soluta Kuroda, 1936, p. 185.—Kira, 1954, p. 55, pl. 27, fig. 18. (Not *Buccinum solutum* Hermann, 1781.)

Shell medium for the group, slender, with 6.25 gradually expanding whorls, including 2 nuclear whorls. External surface of shell reddish brown, with fine grayish white longitudinal lines corresponding to the incremental lines. Interior of aperture whitish, porcellaneous, banded with brown at margin of external lip. Nuclear whorls broad, white. Whorls of the shell characterized by a keel at the shoulder, the keel beginning faintly on the first postnuclear whorl and becoming increasingly heavier on the anterior whorls, located about two-thirds the distance anterior to the suture, darker than the remainder of the shell, with weak blunt or elongated nodules irregularly spaced. Sutures appressed. Aperture fairly narrow; external lip angular. Columella nearly straight, parietal wall brown, internal lip white; anterior canal short, moderately wide, and only slightly reflexed. Nucleus brown, with grayish white incremental lines, showing 9 or 10 major growth interruption lines.

DIMENSIONS: Holotype: height, 68.3 mm.; diameter, 40 mm.; angle of spire, 57°.

TYPE LOCALITY: About 4 miles off Point Barrow base, Alaska. Depth, 175 feet. Bottom: gravel, small stones (haul containing sea urchins—*Strongylocentrotus drobachiensis*). Collected by G. E. MacGinitie, Oct. 14, 1949.

Repositories: Holotype, U. S. National Museum, No. 602,694. Paratypes, U. S. National Museum, Nos. 606,132 (2); 606,136 (1); 606,141 (1); 606,142 (3); 606,144 (3); 606,146 (3). Other paratypes in the collections of the California Academy of Sciences, Stanford University, and Zoological Museum, Copenhagen.

Other localities: Specimens in the U. S. National Museum from the Arctic Ocean and Bering Sea. Also from northern Japan.

Remarks: In addition to the type, 13 living specimens were dredged: 1 (66.5 by 37 mm) at Eluitkak Pass; 1 (39 by 20.5 mm.) at 125 feet; 1 (48 by 25 mm.) at 130 feet; 1 (65 by 35 mm.) at 150 feet; 4 (55 by 30, 55 by 31, 49 by 27, and 28.5 by 16 mm.) at 152 feet; 1 (69 by 38 mm.) at 184 feet; 3 (43.5 by 36, 63 by 32, and 68 by 38 mm.) at 420 feet; and 1 (39+ mm. long) at 438 feet. A few more or less broken shells inhabited by hermit crabs were dredged at Eluitkak pass, 110, 125, 130, and 150 feet.

In some specimens of this species from Point Barrow the keel is approximately in the middle of the whorl (pl. 14, fig. 10), and in one or two specimens it is closer to the posterior end of the whorl than to the anterior (pl. 14, fig. 7 shows a specimen in which it is slightly nearer the posterior end). In one specimen (pl. 14, fig. 10) the nodules on the last whorl are rather marked. Some specimens lack the brown border along the inner margin of the external lip, and in immature specimens the entire throat is usually brownish. On the last whorl, especially on the last quarter turn, a few shells develop irregularly spaced longitudinal ridges (pl. 14, fig. 10); in such shells the canal, relatively straight in the majority of the shells, is somewhat curved and reflected.

This species differs from *N. heros* and *N. ventricosa* in its consistently darker color and slender shape, in its shorter and narrower aperture, in its straighter columella, and in its shorter, narrower, and generally less reflexed canal. The nucleus is less tapered than that of *N. heros* but usually not so cylindrical as that of *N. ventricosa*. The operculum tends to be narrower than that of either of the above species.

This species is named in honor of A. Th. von Middendorff, who probably first collected an example of the species and who worked on the difficult Arctic neptuneids.

Discussion: Since Middendorff's polynomial designation is not acceptable and since Hermann's *Buccinum solutum* (1781) is a *Buccinum* and not a *Neptunea* as Dall (1907) thought, it is necessary to assign another name to this species.

The shell described by Hermann was purchased at an auction in Paris several years prior to the publication of his description and no locality was given. The shell (pl. 27) is obviously a lamellose speci-

men of *B. undatum* Linnaeus that had, as Hermann repeatedly stresses, grown irregularly as the result of untoward circumstances.

As Dall (1921) cites page 53 of Hermann (1781) for *Buccinum solutum* Hermann instead of page 52, where Hermann's description begins, it is possible that he read for the description the next one after *B. solutum*. In the collections of the U. S. National Museum, Dall identified and labeled as *Chrysodomus solutus* (Hermann) specimens of both *Neptunea heros* (see preceding species) and *N. middendorffiana*. A search of the literature fails to reveal any illustration of "*Chrysodomus solutus* (Hermann)" by Dall, but his conception of it has found its way into Japanese literature, as evidenced by Kuroda (1936)[10] and Kira (1954), the obvious explanation being that Dall either identified specimens for some Japanese worker or that a Japanese visitor at the U. S. National Museum got his ideas from specimens labeled by Dall.[11]

It is here suggested that "*Neptunea soluta* (Hermann)" be dropped from our list of western shells and that *B. solutum* Hermann fall as a homonym of *B. undatum* Linnaeus.

Although the shells of *Neptunea* were easily separable into the three species given herein, there remains the possibility that *N. middendorffiana* may be the male of another species. On the basis of the nucleus. *N. middendorffiana* shows closer affinity to *N. ventricosa* than to *N. heros*. By the time the problems involving *Neptunea* arose, I did not have available the soft parts with which to make determinations of sex.

Genus *Plicifusus* Dall, 1902

Plicifusus kroyeri (Möller, 1842)

PLATE 10, FIGURES 11–13

Fusus kroyeri Möller, 1842a, p. 18; 1842b, p. 91.—Kobelt, 1887, p. 85, pl. 15, figs. 1–3.

? *Fusus verkruzeni* Kobelt, 1876, p. 70, pl. 2, fig. 1.

Sipho kroyeri Tryon and Pilsbry, 1879–1898, vol. 3, p. 130, pl. 53, figs. 333–336.

Plicifusus verkruzeni Oldroyd, 1927, pt. 1, p. 208.

Plicifusus kroyeri Oldroyd, 1927, pt. 1, p. 206.—Morris, 1952, p. 127, pl. 29, fig. 2.

Twelve living specimens were dredged: 1 (30.5 mm. in height) from 120 feet (Sept. 15, 1948); 3 (50, 55.3, and 57 mm. in height) from 125 feet; 1 (28.8 by 14.5 mm.) from 130 feet (Sept. 15, 1948); 4 (40.4 by 16.6 mm., 40.4 by 20 mm., 42.3 by 18 mm., and 48.1 by 19 mm.)

[10] For several of these Japanese references I am indebted to Dr. Katura Oyama.

[11] Since this was written, Dr. Oyama has informed me that it is his understanding that Dr. Dall identified some specimens for the late Y. Hirase and that Kuroda, successor to Hirase, followed Dall's identification and that Kuroda identified the specimen reported by Kinoshita and Isahaya and the one figured by Kira.

from 184 feet; 1 (15.7 by 7.1 mm.) from 341 feet; and 2 (44.6 by 17.6 mm., and 52.7 by 22 mm.) from 420 feet. The largest specimen is a dead shell, measuring 69.3 mm. in height, from 150 feet.

Some of the living shells had the usual quota of foraminifers and small barnacles, and in several there were large areas covered with colonies of bryozoans.

Other material examined.—Three specimens from Point Barrow and the "Arctic Ocean," several specimens (labeled *P. verkruzeni*) from Icy Cape, Cape Prince of Wales, Bering Strait, Plover Bay, and Queen Charlotte Sound, British Columbia; about 25 specimens from the Grand Banks, Green Bank, Labrador, and the Gulf of St. Lawrence.

Discussion: The greatest variations in the specimens from Point Barrow, as well as in those from other localities, are in the strength of the axial ribs (see pl. 10, figs. 11–13), which range from those that are practically obsolete through medium to stout, and in the proportion of the length of the aperture to the remainder of the shell. The latter variation is shown in table 3. The 2 specimens from 341 feet have only weak folds near the sutures (as in Tryon and Pilsbry, vol. 3, pl. 53, fig. 336); the dead shell from 150 feet has prominent, stout ribs (loc. cit., pl. 53, fig. 335); others have ribs that are intermediate in strength (loc. cit., pl. 53, fig. 334); and still others may have stout, prominent ribs on the apical whorls and only faint ones on the body whorl. Some shells are twice as thick or heavy as others of comparable size. The throat varies from a deep buff to white faintly tinged with light buff.

Several of the Point Barrow specimens correspond with those that Dall identified as *P. verkruzeni* (Kobelt). However, Dr. Thorson, who examined about half of them on his recent visit to the West Coast, says that they correspond fully with varieties of *P. kroyeri* in the Danish collections from Greenland, and Tryon and Pilsbry illustrate a relatively smooth form of *P. kroyeri*. In his description of *P. verkruzeni*, Kobelt speaks of an ovately turreted, almost smooth shell, with a very short, solid canal. His description was based on two specimens brought back by Verkruzen from Porsangen Fjord in

Table 3.—*Comparison of length of aperture and remainder of shell in specimens of* Plicifusus kroyeri

Shell	*Length of aperture (in mm.)*	*Length of remainder of shell*
1. Adult, with stout ribs	25. 2	25. 0
2. Immature, with stout ribs	14. 5	15. 7
3. Adult, with stout ribs on apical whorls, weak on last whorl	27. 7	31. 4
4. Adult, smooth form with weak folds on apical whorls	19. 7	26. 0
5. Similar to No. 4	22. 2	30. 2

northern Norway. Inasmuch as no other specimens of *P. verkruzeni* seem to exist and in view of the lack of conflict between the description of *P. verkruzeni* and certain forms of *P. kroyeri*, it is possible that the former is merely a smooth, slender form of *P. kroyeri*.

DISTRIBUTION: Burch (1945, No. 50, p. 16) gives the Pacific range of *P. kroyeri* as Point Barrow to Vladivostok, Gulf of Peter the Great, the Japan Sea, and the east coast of Siberia [and there are specimens in the U. S. National Museum from British Columbia]; and Thorson (1944) gives the Atlantic range as Parry Island to Labrador, Newfoundland to Cape Cod, Greenland, Jan Mayen, and Spitzbergen.

Genus *Volutopsius* Mörch *in* Rink, 1857

An orange-brown, thimble-shaped, empty capsule of some species of *Volutopsius* washed ashore on Oct. 21, 1949. The capsule is 22 mm. long by 21 mm. in diameter, large enough to belong to *V. stefanssoni*.

Volutopsius stefanssoni Dall, 1919

PLATE 12, FIGURE 7

Volutopsius stefanssoni Dall, 1919c, p. 22, pl. 1; 1921, p. 89, pl. 9, fig. 2.—Oldroyd, 1927, pt. 1, p. 187, pl. 16, fig. 9; pl. 19, fig. 2.

Two specimens were taken: one, a dead shell with 4.5 whorls, including the nucleus, taken at a depth of 110 feet (Sept. 8, 1948), is 62 mm. high by 35 mm. in diameter (pl. 12, fig. 7); the other, a live specimen with 5.5 whorls, a brown throat and a white pillar, and partially covered with a thin, medium-brown periostracum, taken at Eluitkak Pass (40 feet, on Aug. 10, 1948), is about 75 mm. high by about 42 mm. in diameter.

OTHER MATERIAL EXAMINED: 13 specimens from the Sea Horse Islands, Plover Bay, near Nunivak Island, and near the Pribilofs.

DISCUSSION: Some of these shells have a much longer spire in relation to the length of the aperture than do others. In some the whorls are somewhat flat rather than inflated, and the shoulder is rounded in some and almost angular in others. In some the "obscure swellings at the shoulder" are quite pronounced. One from near the Pribilofs has a yellowish tan periostracum.

DISTRIBUTION: Point Barrow, the type locality, southward to the 57th parallel.

Family Fusinidae

Genus *Ptychatractus* Stimpson, 1865

Ptychatractus occidentalis Stearns, 1871

Plate 5, figure 10

Ptychatractus occidentalis Stearns, 1871, p. 1.—Dall, 1921, p. 87, pl. 6, fig. 8.—Oldroyd, 1927, pt. 1, p. 175, pl. 7, fig. 1.

Eight living specimens were dredged: 3 (averaging about 24 mm. high) from 341 feet; 2 (28.3 and 30.3 mm. high) from 438 feet; and 3 (from 15.8 by 7.5 mm. to 22.1 by 10.7 mm.) from 453 feet. Four shells were washed ashore and 8 shells were dredged from depths of 152 to 741 feet. Most of the dead shells were broken and encrusted with bryozoans and barnacles.

Other material examined: The type, from the Shumagins, and 3 other specimens from the Shumagins, Bering Island, and Iliuliuk, Unalaska.

Discussion: The specimens from Point Barrow are larger than those examined from more southerly waters.

This species is closely allied to *P. ligatus* (Mighels and Adams) from the western Atlantic, differing from the latter in the following respects: More numerous ridges (from 10 to 11 on the body whorl as compared with about 7 in *P. ligatus);* wider ridges and narrower grooves; rounded ridges in *P. ligatus,* usually flat and squarely cut down to the grooves in *P. occidentalis.* In the larger specimens of *P. occidentalis* the ridges may be somewhat rounded, but they are not narrow as in *P. ligatus.*

Distribution: Point Barrow southward to about the 57th parallel of latitude. It is new to Arctic Alaska.

Suborder Toxoglossa

Family Cancellariidae

Genus *Admete* Möller, 1842

Admete couthouyi (Jay, 1839)

And varieties

Plate 2, figures 1–3

Cancellaria buccinoides Couthouy, 1838, p. 105, pl. 3, fig. 3. [Preoccupied.]
Cancellaria couthouyi Jay, 1839, p. 77.—Gould, 1841, p. 283, fig. 190.
Admete crispa Möller, 1842a, p. 15.
Cancellaria (Tritonium) viridula Middendorff, 1849d, vol. 6, pt. 2, p. 439, pl. 9, figs. 13, 14 [=var. *laevior* Leche]; pl. 10, figs. 1, 2 [=varieties]; pl. 10, figs. 3, 4.
Admete couthouyi var. *laevior* Leche, 1878, new ser., vol. 16, p. 48.
Admete middendorffiana Dall, 1885a, vol. 7, p. 524.

Cancellaria (*Admete*?) *middendorffiana* Dall, 1886, vol. 9, p. 297.
Cancellaria middendorffiana Dall, 1902, vol. 24, p. 516, pl. 38, fig. 6.
Admete couthouyi Oldroyd, 1927, pt. 1, p. 157, pl. 16, fig. 2.—Grant and Gale, 1931, p. 622.—Morris, 1952, p. 144, pl. 30, fig. 11.

Five living specimens were collected: 1 (14.5 by 8 mm.) at Eluitkak Pass; 1 (15.4 by 8.9 mm.) at 162 feet; 1 (17.3 by 9.9 mm.) at 295 feet; and 2 (14 by 7.8 mm., and 14 by 7.9 mm.) at 341 feet. Two empty shells were taken: 1 (18.8 by 11.9 mm.) at 80 feet (Aug. 21, 1948); and 1 (9.9 by 6.6 mm.) at 741 feet.

Other material examined: About 75 specimens (labeled *A. middendorffiana*) from localities ranging from Dease Inlet south to Nunivak Island, Alaska; about 80 specimens (labeled *A. couthouyi*) from localities ranging from the Sea Horse Islands, Alaska, to Point Loma, Calif.; about 30 specimens (labeled *A. couthouyi*) from localities ranging from Labrador, Newfoundland, and Maine to Massachusetts; and 12 specimens from Finmark and Vadsø, Norway.

Discussion: Time did not permit the exhaustive study necessary for determining with absolute certainty that *A. middendorffiana* is merely a variety or form of *A. couthouyi* but it is reasonably certain. Grant and Gale (1931) consider *A. middendorffiana* a low-spired form of *A. couthouyi*. Certainly there are many individuals that could as easily be assigned to one as the other species. If these are distinct species, as seems highly doubtful, then there are specimens of *A. middendorffiana* on the East Coast. A specimen from the Gulf of Maine has very weak axial ribs, is somewhat tumid, and has spiral sculpture resembling that of *A. middendorffiana*. Another specimen from Newfoundland has the short spire and tumid body of *A. middendorffiana*, but with the ribbing and spiral sculpture more closely resembling those of *A. couthouyi*. Six specimens from Labrador are all characterized by weak axial ribbing, but four of them have a long spire and the other two have a short spire and are somewhat tumid. Some of the specimens from the West Coast that are labeled *A. couthouyi* have weak ribs, a short spire, and flat, spiral bands with narrow interspaces. Others from the same locality have the axial ribs almost lacking, a long spire, and narrow spiral cords with interspaces wider than the cords.

There are all combinations of short to long spires, slenderness to obesity, axial ribs varying from prominent and sharp to those scarcely perceptible at the sutures, and of narrow spiral threads with wider interspaces to flat, spiral bands with interspaces narrower than the bands.

Several specimens from off southern California have prominent axial ribs and spiral cords that cause the shells to be nodulous. All of the specimens from Norway have a long, pointed spire, and the majority

are nodulous. The specimens from the east coast of North America tend to be smaller than those from the Alaskan Arctic.

One of the shells from Point Barrow (from 80 feet) is like a typical *A. middendorffiana* (pl. 2, fig. 1), that is, with a short spire, whorls rapidly increasing in size, with an obese body whorl, and weak axial plications anterior to the suture. The two young specimens from 341 feet (pl. 2, fig. 2) have a spire like that of *A. couthouyi*, that is, with strong axial ribs and spiral cords, giving a nodulous appearance. The others have a combination of characters of both *A. middendorffiana* and *A. couthouyi* (pl. 2, fig. 3).

It is probable that Dall's *A. middendorffiana* is synonymous with Leche's var. *laevior*, in which event var. *laevior* has priority.

Distribution: *Admete couthouyi* is circumpolar: it has been reported from north of Alaska, Canada, Europe, and Siberia, and from many of the major northern islands. It occurs from Alaska south to southern California and to Japan; from Baffin Bay and Greenland south to New England; and from Spitzbergen south to the Faroes.

Admete regina Dall, 1911

Plate 5, figure 1

Admete regina Dall, 1911, p. 19.—Oldroyd, 1927, pt. 1, p. 156.

A single, very recently empty shell of this species was dredged at 522 feet. It measures 36.6 mm. in height by 22.9 mm. in diameter. The spiral sculpturing is largely worn off.

Other material examined: Four beach-worn specimens from Icy Cape and 13 from Cape Prince of Wales, Plover Bay, the Pribilofs, and the Kudobin Islands; 1 specimen from the Gulf of St. Lawrence, 1 from off Beachy Island, Labrador, and 1 young specimen from 101 fathoms from "Chebucto" Head (=Chedabucto ? Head, Nova Scotia).

Discussion: Although only 20 specimens were examined, they displayed several variations. The specimen from off Beachy Island, Labrador, and the one from the Gulf of St. Lawrence have mouths that flare less than those of typical specimens; one from off the Kudobin Islands has a less obese body whorl, a more tapered spire, and a relatively longer and less flaring aperture. A shell from Cape Prince of Wales is unusually heavy. Two medium-small specimens from Plover Bay have only 2 or 3 visible columellar plaits instead of 6, and the one from Chedabucto Head has only 4 or 5.

Distribution: Point Barrow southward to the Pribilofs and the Aleutians (about lat. 56° N. and long. 161° W.); Labrador to the Gulf of St. Lawrence. Point Barrow is a new locality. This species has not been reported previously from the western Atlantic.

Family Turridae

Some of the generic names, such as *Bela* and *Lora*, formerly used in this family are not available. Several new genera (see Bartsch, 1941) have been erected, but these and the other available generic names do not cover the entire family. Consequently, it is impossible to assign some species to a genus. In this paper, such species have been placed under "*Oenopota*."

Genus *Obesotoma* Bartsch, 1941

Obesotoma tenuilirata (Dall, 1871)

Plate 16, figure 1

Bela tenuilirata Dall, 1871, p. 98.
Lora tenuilirata Dall, 1919a, p. 42, pl. 15, fig. 4.

Four specimens were dredged: 1 living specimen (17.4 mm. high by 8.8 mm. in diameter) from 132 feet; 1 living (12.6 by 6 mm.) and 1 dead (12.4 by 6 mm.) from 217 feet; and 1 living (11.4 by 5.5 mm.) from 477 feet. In the specimen from 132 feet the ribs of the apical whorls are more or less eroded and the nucleus is worn but not decorticated.

Other material examined: The type, from Norton Sound, and approximately 20 other specimens from localities ranging from Point Barrow to Bristol Bay.

Distribution: Point Barrow to Hagemeister Island, and Unimak Island in the Aleutians. Dall (1921) gives the southeastern range as the Shumagins, but I could find no specimens nor records of specimens from east of Hagemeister and Unimak Islands. Johnson (1934) gives the Atlantic range as "off Martha's Vineyard, 365 fathoms."

Obesotoma sp. 1

Four shells were dredged: 1 (14.4 by 7 mm.) from 125 feet; 1 (14.8 by 7.2 mm.) from 213 feet; 1 (9 by 4.5 mm.) from 216 feet; and 1 (15.8 by 7.5) from 149 feet.

Discussion: These specimens correspond to Bartsch's manuscript species No. 227, of which there are 7 specimens (from Plover Bay) in the collection of the U. S. National Museum.

Distribution: Point Barrow, Alaska, and Plover Bay, Siberia.

Obesotoma sp. 2

Two living specimens were dredged: 1 (15.1 by 7 mm.) at 130 feet on Aug. 9, 1949; and 1 (14.6 by 6.8 mm.) at 216 feet.

Discussion: These two specimens agree fairly well with Bartsch's manuscript species No. 135, of which there are 3 dead and worn shells

in the collection of the U. S. National Museum. The columellas of the Point Barrow specimens appear straighter than in species No. 135.

DISTRIBUTION: Point Barrow and southward.

***Obesotoma simplex* (Middendorff, 1849)**

PLATE 16, FIGURE 2

Pleurotoma simplex Middendorff, 1849b, p. 19; 1849c, pt. 2, p. 119; 1849d, pt. 2, p. 448; 1851, vol. 2, pt. 1, p. 223, pl. 12, figs. 15, 16.
Bela simplex G. Sars, 1878, p. 239, pl. 17, fig. 4; pl. 23, fig. 11.
Bela ? laevigata Dall, 1871, p. 98, pl. 16, fig. 7.
Bela laevigata Dall, 1886, p. 300, pl. 3, fig. 7.

Four specimens were washed ashore: 1 dead (11.6 by 6 mm.) on Sept. 12, 1 living (11.5 by 6.1 mm.) on Sept. 23, 1949; and 2 living (11.6 by 7.2 mm. and 11.7 by 6.3 mm.) on July 26, 1950.

OTHER MATERIAL EXAMINED: The type of *B. laevigata*, from St. Michael, Alaska, 35 specimens from Norton Sound, and 20 specimens from Chirikoff Island; and (labeled *B. simplex*) 2 large specimens from Spitzbergen, 6 (from small to large) from Norway, and 2 large specimens from Russian Lapland.

DISCUSSION: Although Sars examined specimens of this species from the Pacific and identified them as *B. simplex*, Dall believed they were sufficiently different to warrant a new species and he described them as *B. laevigata*. That Sars considered this a highly variable species is shown by his two figures (as listed in the synonomy above). After examining one of the specimens in the MacGinitie collection, Dr. Thorson wrote me that it agrees closely with some of the specimens from eastern Greenland. He added that it is an extremely variable species. Something of the variability in proportions is illustrated by the measurements given above.

Although it was a living specimen, the shell taken on September 12 is deeply pitted and the spire is badly eroded (pl. 16, fig. 2). The outer lip is broken and the shell shows two previous breaks along old lip lines.

DISTRIBUTION: Point Barrow to Chirikof Island (about lat. 55.5° N. and long. 155.5° W.) and the Sea of Okhotsk; and (Thorson, 1944) eastern Greenland, northern and eastern Iceland, Spitzbergen, and northern Norway.

***Obesotoma* sp. 3**

Two living specimens of this species were dredged: 1 (13.7 by 7 mm.) at 341 feet and 1 (11.1 by 5.9 mm.) at 741 feet.

DISCUSSION: These two specimens are the same as Bartsch's manuscript species No. 232, of which there is one somewhat worn specimen (from southeast of Kamchatka) in the collections of the U. S. National Museum.

DISTRIBUTION: Point Barrow, Alaska, to southeast of Kamchatka.

Genus *Oenopota* Mörch, 1852

Oenopota nazanensis (Dall, 1919)

PLATE 16, FIGURE 3

Lora nazanensis Dall, 1919a, p. 45, Pl. 15, fig. 8.

Two living specimens were dredged: 1 (10.7 by 6.1 mm.) at 216 feet, and 1 (8.2 mm. high) at 295 feet. The nucleus and ribs of the whorls of the spire are somewhat eroded.

OTHER MATERIAL EXAMINED: One specimen, labeled No. 71. This may be the figured type, since the latter was missing from its vial.

DISTRIBUTION: Dall (1921) gave the range of this species as Norton Sound to the Aleutians, but there is no record of any specimen from north of the type locality, Nazan Bay. The present range is Point Barrow, the Aleutians, Kodiak Island, Elrington Island in Prince William Sound, and Portage Bay (see Burch, 1946, No. 62, p. 17, for collecting data on the latter localities). The Point Barrow specimens extend the range into the Arctic—from the 60th to the 71st parallel of latitude.

Oenopota tenuicostata (G. O. Sars, 1878).

PLATE 16, FIGURE 4

Pleurotoma tenuicostata M. Sars, 1869, p. 259 (nomen nudum).
Bela tenuicostata G. Sars, 1878, p. 237, pl. 17, figs. 1a-b.

A single living specimen, 7.8 mm. in length by 3.7 mm. in diameter, was dredged at 420 feet. The periostracum is worn from the nucleus but the shell is otherwise in excellent condition.

DISCUSSION: Dall (1921, p. 74) cites M. Sars as the authority for this species, but M. Sars (1869) gives only the name without any description or illustration. The description by G. O. Sars (1878) appears to be the first published one.

DISTRIBUTION: Point Barrow, St. Lawrence Island, Nunivak Island, and Safety Cove, Alaska. Johnson (1934) gives the east coast range as Eastport, Maine, to southeast of Nantucket, R. I.; and Thorson (1944) lists eastern and western Greenland, northern and eastern Iceland, Jan Mayen, Spitzbergen, and northern and southern Norway. The Point Barrow specimen extends the range northward from the 60th to beyond the 71st parallel.

Oenopota harpa (Dall, 1885)

PLATE 6, FIGURES 5, 6

Bela harpa Dall, 1885a, p. 523; 1886, p. 300, pl. 4, fig. 2.

Seven living specimens were dredged: 1 (11.8 by 5.5 mm.), through a hole in the ice, at 149 feet; 1 (10.7 by 5.2 mm.) at 152 feet; 1 (10 mm. long, with apex covered with the hydroid *Syncoryne*), through a

hole in the ice, at 162 feet; 2 (14.4 by 6.6 and 15.1 by 6.3 mm.) at 175 feet; 1 (19.1 by 8.8 mm.) at 213 feet; and 1 (10.2 by 5 mm.) at 420 feet. In addition, a dead shell (17.3 by 8.7 mm.) was taken at 110 feet, and another (20.5 mm. long) at 213 feet.

Other material examined: Several specimens in the collection of the U. S. National Museum.

Discussion: There is variation in the number of ribs, and in some specimens there is a tendency toward a shoulder, though the latter is more of an effect than an actuality. The description of this species was published in 1885, not 1884 as given by Dall (1921, p. 75).

Distribution: Point Barrow south and east to the Queen Charlotte Islands, British Columbia. Dall (1921) says that it is circumboreal, but Johnson (1934) does not list it and European authors do not mention it.

"Oenopota" elegans (Möller, 1842)

Plate 16, figures 7, 8

Defrancia elegans Möller, 1842a, p. 13; 1842b, p. 86.
Bela elegans G. Sars, 1878, p. 225, pl. 16, fig. 15.

Four specimens were dredged: 1 living (13.3 by 5 mm.) and 1 recently dead (10.8 by 4.3 mm.) at 152 feet; 1 drilled (12.6 by 4.6 mm.) at 175 feet; and 1 living (12.2 by 4.9 mm.) at 204 feet.

Discussion: Dr. Thorson compared these specimens with Möller's type specimens from western Greenland. He says that the one from 204 feet (pl. 16, fig. 8) is a trifle broader than the types, but that the others are quite typical (pl. 16, fig. 7). He adds that, after examining specimens from Iceland, Greenland, and New England, he is inclined to believe that G. Sars' figure (1878, fig. 15 on pl. 16) is of an extreme variant of the species.

Distribution: Point Barrow and Blizhni Islands to St. Lawrence Island, Bering Sea; also (Thorson, 1944) Iceland, western Greenland, Spitzbergen, and northern and southern Norway. Point Barrow is a new locality.

"Oenopota" harpularia (Couthouy, 1838)

Plate 16, figure 9

Fusus harpularius Couthouy, 1838, p. 106, pl. 1, fig. 10.—Gould, 1841, p. 291, fig. 191.
Defrancia woodiana Möller, 1842b, p. 86.
Bela harpularia G. Sars, 1878, p. 234, pl. 23, fig. 10; pl. 16, fig. 17.
Lora harpularia Morris, 1951, p. 22, pl. 39, fig. 6.

A single living specimen (11.4 by 4.9 mm.) was dredged at 130 feet on Aug. 9, 1949. This specimen is white, tinged with creamy buff near some of the sutures and nodes.

Distribution: Point Barrow to Puget Sound; and (Thorson, 1944)

Grinnell Land to Labrador, Newfoundland, and Cape Cod, Mass.; northern and eastern Iceland, and northern and southern Norway.

"Oenopota" pyramidalis (Strøm, 1788)
And varieties

PLATE 16, FIGURES 10–13, PLATE 17, FIGURES 6, 7

Buccinum pyramidale Strøm, 1788, p. 297, pl. 1, fig. 22.
Fusus pleurotomarius Couthouy, 1838, p. 107, pl. 1, fig. 9.
Defrancia vahlii Möller (ex Beck MS.), 1842b, p. 86.
Pleurotoma pyramidalis Mörch, 1869, p. 22.
Pleurotoma pyramidalis var. *jenisseensis* Leche, 1878, p. 56, pl. 1, figs. 17a–b.
Bela pyramidalis G. Sars, 1878, p. 222, pl. 16, fig. 3 (typical form).
Bela pyramidalis var. *semiplicata* G. Sars, 1878, p. 222, pl. 16, fig. 4.

Three specimens were collected: 1 recently vacated shell (19.8 by 7.4 mm.), with part of the nucleus missing, was taken at 295 feet; 1 living (17.7 by 7 mm.) at 453 feet; and a broken shell at 477 feet. These shells are white. (See pl. 16, figs. 10, 11.)

In addition to the above, 3 specimens of what are probably *"O." pyramidalis* var. *semiplicata* G. O. Sars were taken: 2 living specimens (12.8 by 5.8 mm. and 14 by 6.1 mm.) from 152 feet; and 1 drilled shell (15.4 by 6.9 mm.) from 216 feet. The dead shell is white, the living ones are an olive tan. (See pl. 16, figs. 12, 13.) A specimen 11.7 mm. high from 217 feet was identified by Dr. Thorson as *Bela pyramidalis* var. *vahli* (pl. 17, figs. 6, 7).

DISCUSSION: Dr. Thorson wrote me that the specimens of *"O." pyramidalis* from Point Barrow are somewhat larger, but otherwise fully agree with the type and with specimens from Iceland and western Greenland. Mörch (1869) gave the name var. *gigantea* to the largest specimens. Dr. Thorson also stated that the specimens of var. *semiplicata* have the same structure and sculpture on the uppermost whorls as a specimen in the collection from the Murman Coast, but that the Point Barrow specimens are larger and the last whorl is more tumid. Some of the specimens appear to be identical with Leche's (1878) figure of var. *jenisseensis*.

DISTRIBUTION: Point Barrow to Friday Harbor, Wash. (see Burch, 1946, No. 62, p. 21, for collecting data from the Aleutians to Friday Harbor); and (Thorson, 1944) Grinnell Land to Labrador; western and eastern Greenland; all Iceland, Jan Mayen, Spitzbergen, and northern and southern Norway. The specimens from Point Barrow extend the range into the Pacific area of the Arctic.

Genus *Nodotoma* Bartsch, 1941

Nodotoma impressa (Mörch, 1869, ex Beck MS.)

PLATE 16, FIGURES 14, 15

Pleurotoma impressa Mörch, 1869, p. 21.—Leche, 1878, p. 54, pl. 1, fig. 16.
Bela impressa Friele, 1886, vol. 3, p. 18, pl. 8, figs. 1, 2; pl. 10, fig. 9.
Nodotoma impressa Bartsch, 1941, p. 5, pl. 1, fig. 2.

Three specimens were collected: 1 drilled shell (10.2 by 4.9 mm.) from 216 feet; 1 living (8.2 by 4.2 mm.) from 295 feet (pl. 16, fig. 14); and 1 living (9.9 by 4.8 mm.) from 477 feet (pl. 16, fig. 15). The nucleus of the latter was worn but entire and some of the ribs were partly eroded. The nucleus of the one from 295 feet was rather badly worn and the ribs of the first two postnuclear whorls were also badly eroded.

OTHER MATERIAL EXAMINED: Several specimens in the collection of the U. S. National Museum.

DISTRIBUTION: Point Barrow and the Sea Horse Islands to Kodiak Island; and Spitzbergen. Point Barrow is a new locality.

Genus *Raphitoma* Bellardi, 1848

Raphitoma amoena ? G. O. Sars, 1878

PLATE 8, FIGURE 8

? *Raphitoma amoena* G. Sars, 1878, p. 220, pl. 17, figs. 10a–b.—Thorson, 1935a, p. 48, figs. 48–49.

Six specimens were dredged: 1 (about 3 mm. long) at 184 feet; 3 (about 2.2, 2.3, and 2.7 mm.) at 216 feet; 1 (about 2 mm.) at 453 feet; and 1 (about 2.5 mm.) at 741 feet.

DISCUSSION: The largest of these shells have 3 whorls and perhaps a fraction of another whorl, including the nucleus. They have very prominent, sharp, spiral folds (pl. 8, fig. 8) that are confined to the periostracum—2 folds on the last whorl and 1 on the next to the last. As in some of the other small shells, the calcified portions have dissolved.

Dr. Thorson, who examined some of these shells, believes that they are either young bottom stages of *Raphitoma amoena* or of some other species of *Raphitoma*. I do not have enough comparative material to continue the study of this species.

DISTRIBUTION: Point Barrow ?; and (Thorson, 1944) eastern and western Greenland, Jan Mayen, Spitzbergen, and Norway north of Lofoten.

Subclass Euthyneura

Order Opisthobranchia

Suborder Tectibranchiata

Family Acteocinidae

Genus *Retusa* Brown, 1827

Retusa umbilicata (Montagu, 1803)

Plate 4, figure 6

Bulla umbilicata Montagu, 1803, ed. 1, vol. 1, p. 222.
Cylichna nitidula Lovén, 1846, p. 142.
Cylichna strigella Lovén, 1846, p. 142.—Tryon and Pilsbry, 1893, vol. 15, p. 210, pl. 27, figs. 7, 8; pl. 29, figs. 11–14.
Utriculus nitidulus G. Sars, 1878, p. 286, pl. 17, fig. 13; pl. 26, fig. 3.
Utriculus umbilicatus G. Sars, 1878, p. 286, pl. 17, fig. 14.
Retusa umbilicata Lemche, 1948, pt. 1, p. 81, fig. 45; pt. 2, p. 81, figs. 59–61.

A single dead shell of this species was taken on Sept. 6, 1949, at a depth of 477 feet. The shell is 2.8 mm. in height by 1.5 mm. in width.

Other material examined: Approximately 200 specimens from the Shetlands, Scotland, Ireland, Sweden, Norway, the Bay of Biscay (1 specimen) and the Gulf of Naples (1).

Discussion: Lemche (1948) discusses and figures many of the variations found in this species. Among the specimens I examined there were some with a large umbilicus, others with a small umbilicus, and still others with no umbilical perforation; in some there were distinct axial striae and in others such striae were lacking; in some the apical perforation was distinctly visible, in others it was feeble, and in still others it was lacking. One finds all possible combinations of these various characters; for example, one shell may have striae and an umbilicus, another may have striae and no umbilicus and yet another may have neither.

In the specimen from Point Barrow (pl. 4, fig. 6) the apical perforation could be considered lacking or very feeble, the umbilical perforation is lacking, and longitudinal striation may be said to be lacking, for even under high magnification there is such a faint indication of it that one could scarcely term it striation. It is similar to figure 13 of G. Sars (1878) and figure 11 of Tryon and Pilsbry (1893). In the majority of other specimens that I examined the axial striation was lacking.

Distribution: Point Barrow, Alaska; the east coast of North America; Norway and Sweden, the British Isles, the Shetlands, the Bay of Biscay, and the Gulf of Naples.

Family Diaphanidae

Genus *Diaphana* Brown, 1827

Diaphana minuta Brown, 1846

Var. *hiemalis* Couthouy

Diaphana minuta Brown, 1827, p. 11, pl. 38, fig. 7.—Lemche, 1948, pt. 1, figs. 31–35; pt. 2, p. 72, figs. 1–21.—Abbott, 1954, p. 277, fig. 59b.
Diaphana candida Brown, 1827, pl. 38, figs. 13, 14; 1844, p. 59.
Bulla hyalina Turton, 1834, p. 353.
Bulla hiemalis Couthouy, 1839, p. 180, pl. 4, fig. 5.
Bulla debilis Gould, 1840, p. 196; 1841, p. 164, fig. 95.
Bulla subangulata Möller, 1842b, p. 79.
Utriculus candidus Brown, 1844, p. 59, pl. 19, figs. 13, 14.
Amphisphyra globosa Lovén, 1846, p. 143.
Amphisphyra expansa Jeffreys, 1865a, p. 330.
Diaphana hyalina G. Sars, 1878, p. 289, pl. 18, figs. 1a–b.
Diaphana expansa G. Sars, 1878, p. 289, pl. 18, figs. 2a–b.
Diaphana globosa G. Sars, 1878, p. 290, pl. 18, figs. 3c, 4.
Diaphana hiemalis G. Sars, 1878, p. 291, pl. 18, figs. 3a–c.
Diaphana glacialis Odhner, 1907, vol. 41, pp. 53, 97, pl. 1, figs. 1–5.
Diaphana spirata Odhner, 1907, vol. 41, pp. 53, 97.

Two living specimens were dredged, the larger (3.5 mm. high by 2.8 mm. in diameter) from 741 feet, the smaller (about 2.9 by 2.2 mm.) from 295 feet.

Other material examined: The figured type of *B. hyalina* and several others from the Shetlands, the British Isles, Norway, and Greenland. The figured type of "*Utriculus*" *expansus* (Jeffreys) and 13 others from the Shetlands, Spitzbergen, Norway, and Greenland. The figured type of *A. globosa* and 15 others from the Shetlands, Norway, and Greenland. And others.

Discussion: Lemche (1948), who has made a thorough morphological study of the northern species of *Diaphana*, finds no difference in the soft parts and radulas of the species names listed in the synonymy above. However, he recognizes 3 varieties of shells in the variable species of *D. minuta*, but finds intergradations between all of these varieties. In typical *D. minuta* var. *minuta* the spire is visible and the aperture is shorter than the shell. In the var. *hiemalis* Couthouy (plus *globosa* Lovén) the spire is hidden, and the aperture extends the full length of the shell. In the var. *spirata* Odhner (1907, p. 97) there is a prominent "first whorl" or larval shell, which may protrude even if the rest of the spire is more or less sunken.

With the exception that the larger one is entirely milky white and the smaller one partially milky white, rather than hyaline, the shells from Point Barrow conform to the description of *D. globosa* and therefore belong to the var. *hiemalis* Couthouy. (A chalky appearance has been noted in several Arctic shells that are supposed

to be hyaline or pearly.) In these 2 specimens the spire is very much sunken and is visible only from an end view; the aperture extends the entire length of the shell and the outer lip extends beyond the vertex.

After examining many shells in the *D. minuta-hiemalis-globosa-debilis-hyalina* complex, it becomes obvious that they all belong to the same species, for there are all types of intergrades. For example, in 3 specimens from Spitzbergen (labeled *U. subangulatus*) there is one in which the apex extends beyond the aperture, one in which only the tip of the apex is visible from the side, and one in which the apex is invisible from the side.

DISTRIBUTION: *D. minuta* is a new name for the Pacific area of the Arctic, but under the name of *D. globosa* it has been recorded from Bering Strait northward. Point Barrow is a new locality. Lemche (1948) lists *D. minuta* from Maine to Massachusetts and the Gulf of St. Lawrence; from Jan Mayen, Spitzbergen, the Murman Coast, the Faroes, the Shetlands, Iceland, northern and southern Norway, western Europe, the Canary Islands, and the Mediterranean.

Family SCAPHANDRIDAE

Genus *Cylichna* Lovén, 1846

Cylichna occulta (Mighels, 1841)

PLATE 4, FIGURE 3

Bulla striata (not Bruguière nor Hutton) Brown, 1827, pl. 38, fig. 41; 1844, p. 57, pl. 19, figs. 41, 42.
Bulla occulta Mighels, 1841, p. 50.—Mighels and Adams, 1842, p. 54, pl. 4, fig. 11.
Bulla reinhardti Möller, 1842b (ex Holbøll, MS.), p. 79.
Bulla scalpta Reeve, 1855, p. 392, pl. 32, figs. 3a–c.
Cylichna propinqua M. Sars, 1859, p. 49.—G. Sars, 1878, p. 284, pl. 18, fig. 5; pl. XI, fig. 5.
Cylichna solitaria Friele (not *C. solitaria* Say), 1878, p. 225.
Cylichna occulta Lemche, 1948, p. 78, figs. 31–40.

One specimen (6 mm. high by 3.5 mm. in diameter) was taken through the ice on Jan. 25, 1950, at a depth of 33 feet; and one (4 by 2.4 mm.) was taken near shore on July 13, 1950. Both were taken with a plankton net when it touched bottom. The flesh of these animals was white and the shell is cream colored.

OTHER MATERIAL EXAMINED: About 55 specimens (including dead shells) from localities ranging from Point Barrow to Kyska Harbor in the Aleutians; about 35 specimens from Novaya Zemlya, Spitsbergen, Norway, Scotland, and Greenland. These were labeled *C. reinhardti, C. striata, C. umbilicata, C. propinqua,* and *C. scalpta.*

DISCUSSION: In his study of the northern species of this genus, Lemche (1948) found that the species listed in the synonymy above all belong to the species *C. occulta*, in which he recognized two varieties: *occulta* and *scalpta*, the latter being broader than var. *occulta*. He also described a new species, *C. magna*, specimens of which had been identified under some of the above names. He found that *C. occulta* and its varieties are found in shallow water, and *C. magna* in deeper water.

In the specimens that I examined, the shells of living specimens range from creamy white to brown, and from those with a closed umbilicus (pl. 4, fig. 3) to those with an open umbilicus.

DISTRIBUTION: Point Barrow to the Aleutians; Greenland to Maine; and (Lemche, 1948) Iceland, Spitzbergen, Finmarken, the Murman Coast, the White Sea, and north of Siberia.

Family PYRAMIDELLIDAE

Genus *Odostomia* Fleming, 1813

Odostomia cassandra Dall and Bartsch, 1913

PLATE 8, FIGURES 5, 6

Odostomia cassandra Dall and Bartsch, 1913, p. 142, pl. 10, fig. 2.

Seven specimens were dredged: 1 (2.8 mm. or more long, with 4 whorls) from 140 feet on Aug. 21, 1948; 1 (1.9 mm., with 3.5 whorls) from 216 feet; 2 (1.4 mm., with 3 whorls; and 1.6 mm., with 3 whorls) from 453 feet; and 2 (1.4 mm., with 2.5 whorls; and 2 mm., with 3 whorls) from 741 feet. In addition, there is a specimen from 741 feet in which the shell was completely dissolved by the preservative. The animal is about 3.2 mm. long and 2 mm. in diameter, and a yellow operculum is present.

OTHER MATERIAL EXAMINED: The type from the Queen Charlotte Islands. (Only 1 other specimen, the cotype, has been recorded.)

DISCUSSION: In these shells the aperture is as long as or longer than the remainder of the shell; there is no sculpturing except fine, silky lines of growth. At first these shells were opaque and white, with a silky sheen, but in alcohol they have become hyaline. The type, which is somewhat larger than the largest specimen (with a shell) from Point Barrow, is not highly calcified and appears somewhat hyaline in spots.

DISTRIBUTION: Point Barrow and Skidegate, Queen Charlotte Islands, British Columbia. The Point Barrow specimens extend the range from the 55th to beyond the 71st parallel of latitude.

Suborder Pteropoda

Family Spiratellidae

Genus *Spiratella* Blainville, 1817

Spiratella helicina (Phipps, 1774)

Clio helicina Phipps, 1774, p. 195.
? *Limacina pacifica* Dall, 1871, p. 138.
Limacina helicina G. Sars, 1878, p. 328, pl. 29, figs. 1a–b.—Odhner, 1907, p. 92.
? *Spiratella pacifica* Abbott, 1954, p. 292, fig. 64a.

Only 2 specimens of this pteropod were taken, both in plankton hauls made on Aug. 6 and Aug. 10, 1948.

Discussion: Since no special attempt was made to collect pelagic forms, the few records for this species are of little significance and no indication of its actual abundance. However, the failure to take *S. helicina* during the summers of open water of 1949 and 1950 is consistent with the lesser numbers of ctenophores, medusae, and jellyfishes as compared with the enormous numbers seen near shore during 1948 when floating ice was present throughout the summer. Workers at the Arctic Research Laboratory reported that *S. helicina* was exceedingly abundant during the summer of 1947, and other workers have reported that untold numbers were seen during certain summers between 1950 and 1955 and almost none were seen during other summers.

Lemche (1938, p. 31) lists *S. helicina* as a true Arctic and circumpolar species and states that it does not occur in boreal waters. Abbott (1954, p. 292) considers *S. pacifica* (Dall) synonymous with *S. helicina* (Phipps). Burch (1945, No. 47, p. 5) gives the range of *S. pacifica* as Point Barrow south to Redondo Beach, Calif., where he took it in 75 fathoms 5 miles offshore. The type locality of *S. pacifica* is Monterey, Calif., and it has been taken at San Francisco; it has been reported also from 30 fathoms at Catalina Island. If *S. pacifica* and *S. helicina* are identical, then *S. helicina* is a Boreal-Arctic species.

Distribution: Circumpolar; Point Barrow south to Monterey, Redondo Beach, and Catalina Island, California (?); Labrador, Davis Strait, and Baffin Bay; and (Odhner, 1907) northern and southern Norway, the White Sea, Spitzbergen, Iceland, the Gulf of Biscay, and the Mediterranean.

Family Clionidae

Genus *Clione* Pallas, 1774

Clione limacina (Phipps, 1774)

Clio limacina Phipps, 1774, p. 195.
Clione limacina Gould, 1870, p. 507, fig. 754.—G. Sars, 1878, p. 332, pl. 29, figs. 4a–e.—Odhner, 1907, p. 95.—Pratt, 1935, p. 578, fig. 758 (after Gould).

During the summers of 1949 and 1950 this species was taken sparingly, but during the summer of 1948 it was very abundant, especially on August 12 when it was seen alongshore in enormous numbers, together with ctenophores, medusae, and jellyfishes.

Discussion: During the winter of 1949–1950, veliger larval forms of this species were taken in vertical plankton hauls through the ice. Throughout the entire winter they appeared to be in a state of suspended growth, for all of the larvae taken were the same size. However, on June 23, 1950, 4 large adults, about 38 mm. in length, were taken in a screen trap lowered through the ice where the water was 37 feet deep. On July 7, 1950, a larval form 7 mm. in length, that was still propelling itself by means of cilia, and a specimen 30 mm. in length were taken. About this time young *C. limacina* were becoming common alongshore.

Distribution: This is a Boreal-Arctic species that has been recorded in Pacific waters from northern Bering Sea south to the Pribilofs and, rarely, in the Aleutians, hence not farther south than lat. 52° N.; in eastern Atlantic waters it has been recorded from the White Sea, Jan Mayen, Spitzbergen, the British Isles, and the Faroes—as far south as lat. 35° N.; and in the western Atlantic (Johnson, 1934) from Davis Strait to lat. 37° N. In view of its abundance at Point Barrow, it is surprising that it has not been recorded previously from north of Bering Sea.

Suborder Nudibranchia

Division Doridacea (=Holohepatica)

Family Doridae

Genus *Aldisa* Bergh, 1878

Aldisa zetlandica (Alder and Hancock, 1855)

Doris zetlandica Alder and Hancock, 1855, pt. 7, and appendix, p. 42.—G. Sars, 1878, p. 305, pl. 27, figs. 1a–b.
Aldisa zetlandica Odhner, 1907, p. 67.—Alder and Hancock, 1910, p. 105, pl. 1, figs. 3, 4.

Six specimens were collected: 1 (32 mm. long by 30 mm. wide, when somewhat contracted) was dredged from a sandy-muddy bottom

at a depth of 10 feet and a distance of 300 feet from shore on July 20, 1948; 2 were dredged from a sandy bottom at a depth of 10 to 15 feet and a distance of 75 to 150 feet from shore on Sept. 8, 1948; and 3 (34 by 22 by 13 mm., 34 by 21 by 13 mm., and 30 by 21 by 12 mm.) were washed ashore on Oct. 16, 1949.

These animals were white, with a cream colored foot; the gonads showed through as buff, the gut as black. The entire dorsum is covered with small papillae from which fine lines radiate. The mantle extends beyond the foot all around. The rhinophores are located unusually far back and the branchiae very far back on the dorsum. The 12, equal-sized branchiae are in a ring with the anal pore in the center; anal papilla short or absent.

DISTRIBUTION: Point Barrow, Alaska; and (Lemche, 1941) northern and eastern Iceland (in deep water), Finmarken, and other European waters; and (Odhner, 1907) Shetland, and the Azores. It is new to North America.

Division AEOLIDIACEA (=CLADOHEPATICA)

Family DENDRONOTIDAE

Genus *Dendronotus* Alder and Hancock, 1845

Dendronotus frondosus (Ascanius, 1774)

PLATE 3, FIGURE 1

Amphitrite frondosa Ascanius, 1774, p. 155, pl. 5, fig. 2.
Doris arborescens Müller, 1776, p. 229, pl. 101, figs. 1–4.
Dendronotus arborescens Alder and Hancock, 1845–1910, vol. 2, p. 161; fam. 3, pl. 3; Suppl., pl. 47, fig. 2.
Dendronotus frondosus G. Sars, 1878, p. 314.—Odhner, 1907, p. 64.—Lemche, 1941, p. 23.

Twenty specimens were collected: 2 were dredged at a depth of 140 feet on Aug. 21, 1948; and 1 at a depth of 150 feet on Aug. 23, 1949; the remaining 17 specimens washed ashore between Sept. 12 and Oct. 5, 1949. The largest specimen (from 140 feet) was 115 mm. long; the next largest (washed ashore on Sept. 12) was 95 mm. long, 25 mm. wide, and 27 mm. high, and the maximum length of the cerata was 21 mm.

These specimens were a rich, reddish brown on a cream background.

DISTRIBUTION: Point Barrow, and Bering Sea; and (Lemche, 1941) the east coast of North America (Labrador to Cape Cod), western and eastern Greenland; northern and eastern Iceland, the Faroes, the Shetlands, Spitzbergen, Franz Josef Land, northern and southern Norway, and other European waters south to France. It is new to the western Arctic.

Dendronotus sp.

Four animals were collected: 2 were dredged at a depth of 150 feet on Aug. 23, 1948; 1 washed ashore on Sept. 26, 1949, and another on Sept. 28, 1949. These specimens measured up to 40 mm. in length. The bodies were translucent white, with chalk white tips on the branches of the cerata.

Family Flabellinidae

Genus *Coryphella* Gray, 1850

Coryphella salmonacea (Couthouy, 1838)

Eolis salmonacea Couthouy, 1838, p. 68, pl. 1, fig. 2.
Coryphella salmonacea Bergh (not of M. Sars, 1829, nor G. Sars, 1878), 1864, p. 227, pl. 4.—Hägg, 1905, p. 106.—Odhner, 1922, p. 31, fig. 13a.—Lemche 1941, p. 25.
Aeolis papillosa Hägg, 1905, p. 104.

Four specimens were collected: 3 (28, 42, and 42 mm. long) washed ashore on Sept. 26, 1949; and 1 (42 mm. long) washed ashore on Oct. 16, 1949. These animals were pinkish salmon in color.

Two specimens, probably belonging to another species, and possibly to another genus, were dredged: 1 (30 mm. long) at Eluitkak Pass on Aug. 30, 1948; and 1 and a fragment at 110 feet on Sept. 16, 1948. The bodies and tentacles of these 2 animals were white, the cerata brick-red, tipped with white.

Distribution: Point Barrow, Alaska, and (Lemche, 1941) Bering Strait; east coast of North America south to Cape Cod, western and eastern Greenland; northern and eastern Iceland, Jan Mayen, Spitzbergen, and the north coast of Norway. It is new to Point Barrow and to Arctic Alaska.

Class Amphineura

Family Lepidochitonidae

Genus *Trachydermon* Carpenter, 1863

Trachydermon albus (Linnaeus, 1767)

Plate 17, figures 3, 4

Chiton albus Linnaeus, 1767, ed. 12, p. 1107.
Lepidochitona alba Tryon and Pilsbry, 1879–1898, vol. 14, p. 70, pl. 7, figs. 35–38.

Thirty-nine specimens were taken: 1 (13 mm. long) from 120 feet (Aug. 8, 1949); 1 (14 mm.) from 130 feet (Sept. 15, 1948); 1 (9 mm.) from 130 feet (Aug. 9, 1949); 1 (9.5 mm.) from 184 feet; 7 (from 9 to 15 mm.) from 217 feet; 1 (10 mm.) from 328 feet; 2 (13 mm.) from 341 feet; 7 (from 3 to 13 mm.) from 420 feet; 1 (16 mm.) from

438 feet; 9 (from 7 to 17 mm.) from 453 feet; and 5 (from 6 to 15 mm.) from 522 feet.

OTHER MATERIAL EXAMINED: Over 100 specimens from localities ranging from the Sea Horse Islands through Bering Strait, Plover Bay, the Shumagins, the Aleutians, and Juneau, Alaska.

DISCUSSION: The "*albus*" refers to the white of the inside of the valves. Externally, the valves, as well as the girdle, range between a dusty white or cream color (pl. 17, fig. 4) to a condition in which brown predominates (pl. 17, fig. 3), the dark color being due to microscopic specks of pigment. As in specimens from other localities, the darker colored ones predominate at Point Barrow, but in several specimens from 420 feet the white area is greater than that with brown pigmentation.

A single specimen (USNM 214438) from San Francisco Bay labeled *T. albus* does not belong to this species. The "spicules" of the girdle are too fine for *T. albus*, there is a nodule on the posterior valve that is not present in *T. albus*, and the apex of the valves is drawn into a more prominent point than in *T. albus*. The lateral areas are ill defined. A small specimen (USNM 218739) from Monterey Bay is also incorrectly named *T. albus*—the plates are narrower, the sculpture is coarser and in definite rows rather than in an over-all effect as in *T. albus*, and, as in the specimen from San Francisco, it also has the nodule on the posterior valve. In still another specimen (USNM 159351), from San Diego, the "spicules" of the girdle are fine, giving an impression of piling, the sculpture is coarser than in *T. albus*, and the nodule is present. Time did not permit the identification of these 3 specimens, which may represent a new species.

However, 9 specimens (USNM 224045) from the Stearns Collection, labeled "West Coast of Lower California," are *T. albus*.

DISTRIBUTION: Point Barrow south and east to Juneau, Alaska, and, if the above locality record is correct, the west coast of Lower California; the Gulf of St. Lawrence south to Massachusetts Bay; the British Isles; Spitzbergen; Norway.

Family Cryptochitonidae

Genus *Symmetrogephyrus* Middendorff, 1847

Symmetrogephyrus vestitus (Broderip and Sowerby, 1829)

Plate 17, figures 1, 2

Chiton vestitus Broderip and Sowerby, 1829, p. 368.—Sowerby, 1841, pl. 171, *Chiton*, fig. 128.
Amicula vestita J. Gray, 1847b, p. 69.—Oldroyd, 1927, pt. 3, p. 322.
Symmetrogephyrus vestitus Dall, 1921, p. 198.—Abbott, 1954, p. 316, fig. 66c.

Forty-two specimens were dredged: 1 at 138 feet, 1 at 152 feet, 3 at 217 feet, 1 at 295 feet, 2 at 328 feet, 10 at 341 feet, 4 at 420 feet, 5 at 438 feet, 12 at 453 feet, 2 at 522 feet, and 1 (11 mm. long) at 741 feet. They range in length from 11 to 62 mm.

On the epidermis of one chiton from 453 feet an amphipod was curled up in a depression formed to fit it. Young barnacles may be attached to the tips of the valves and foraminifers are often nestled in the depressions formed at the junction of the plates and epidermis. Around one plate there were 11 foraminifers of varying sizes. Foraminifers may also nestle in the epidermis and form depressions to fit, as they do on tunicates. On the chiton from 295 feet, over 15 foraminifers were thus embedded, some so deeply that, with their covering of detritus, they were difficult to see. Also on this chiton, growing attached to or near the base of some of the tufts, were small colonies of the bryozoan *Coriella stolonata*.

Other material examined: Over 20 specimens from localities ranging from off Cape Sabine in the Arctic to Kyska Harbor in the Aleutians; 6 specimens from Nova Scotia, Maine, and Massachusetts Bay.

Discussion: In this chiton only the apex of the valve is visible, the remainder being covered by the expanded girdle, which is dotted with irregularly spaced tufts of stiff bristles. Relatively more of the surface of the valves is visible in smaller than in larger specimens. The girdle is cream colored, the bristles brownish.

The most noticeable variation is in the number of tufts of bristles. In some specimens the tufts are very sparse, in others unusually thick. Some of the specimens from Point Barrow are fairly thickly tufted (pl. 17, fig. 1), others have very few tufts (pl. 17, fig. 2). In 4 specimens from Bering Island the tufts average only about 1 mm. apart. The size of the tufts varies in any individual specimen as well as in different individuals. The spicules on the epidermis may be sparse or thick.

Distribution: Point Barrow south to the Pribilofs, Kyska Harbor in the Aleutians, Hagemeister Island in Bristol Bay. Dall (1921) gives the Atlantic range as "south to Cape Cod." It is new to Point Barrow.

Class Cephalopoda

Order Decapoda

Family Gonatidae

Genus *Gonatus* Gray, 1849

Gonatus fabricii (Lichtenstein, 1818)

Onychoteuthis fabricii Lichtenstein, 1818a, p. 1592, pl. 19; 1818b, p. 13.
Gonatus amoenus G. Sars, 1878, p. 336, pl. 31, figs. 1–15.—Verrill, 1881, p. 291, pl. 45, figs. 1, 2.
Gonatus fabricii Steenstrup, 1881, p. 25, pl. 1.—Hoyle, 1886, pp. 41, 174.—Berry, 1912, p. 308, pl. 52, figs. 1–4; pl. 53; pl. 54, figs. 1–4; pl. 45.—G. E. MacGinitie, 1955, p. 180.

Three specimens, with bodies measuring 59, 63, and 72 mm. in length, were washed ashore on Oct. 1, 1949. (For more detailed measurements, see G. E. MacGinitie, 1955.) The animals were cream colored, spotted with red. (These animals were identified by Dr. Gilbert L. Voss of the University of Miami Marine Laboratory.)

Distribution: Point Barrow, Alaska and (Berry, 1912) Bering Island (east of Kamchatka, approximately latitude 55° N. and longitude 166° W.), British Columbia?, Washington?, Monterey, and off San Nicolas Island, Calif., and off Los Coronados Islands, Lower California; Kuril Island, Japan, Punta Arenas, Patagonia; Davis Strait off Greenland, Iceland, the Faroes, Jan Mayen, Norway, Finmark, Ireland, France, and south of Cape of Good Hope; Nova Scotia and Rhode Island. It is new to Point Barrow and Arctic Alaska.

Order Octopoda

Family Cirroteuthidae

Genus *Cirroteuthis* Porro, 1841

Cirroteuthis sp.

Cirroteuthis sp. G. E. MacGinitie, 1955, p. 179.

Two specimens were taken with a dip net in about 6 feet of water at the outer edge of an ice floe that had stranded along shore. The smaller specimen was a juvenile; the larger had an over-all length of 25.7 cm. (More detailed measurements are given in the above reference.) The dominating color was pale maroon.

Dr. Grace E. Pickford (who identified this and the following species) was unable to place this *Cirroteuthis* specifically because she saw only the juvenile, the larger specimen having been lost in transit.)

Discussion: Dr. Pickford states that this species differs in several respects from a well-known North Atlantic species, and that the only

other record of the genus from the Pacific area is that of a single specimen of *C. hoylei* Robson taken off Valparaiso, Chile, by the *Challenger*.

The appearance of this deeper-water animal along shore is accounted for by upwelling water following an offshore wind of three days duration.

Family Octopodidae

Genus *Benthoctopus* Grimpe, 1921

Benthoctopus hokkaidensis (Berry, 1921)

Polypus glaber Sasaki, 1920, pp. 163, 167, 172 (not *P. glaber* "Ruppell" Wülker).
Polypus hokkaidensis Berry, 1921, p. 352 (new name for *P. glaber* Sasaki, not Wülker).
Octopus hokkaidensis Sasaki, 1929, pp. ii, 33, 63, 66; text figs. 24–26; pl. 4, figs. 4, 5; pl. 11, fig. 5.[12]

One specimen, a gravid female, was taken at a depth of 216 feet on Oct. 6, 1949. The body, marked with light orange on a cream background, was 85 mm. long and 57 mm. in diameter, with arms 150 mm. long.

Distribution: Originally taken off Japan by the *Albatross* and more recently by the Russians in Bering Sea and the Sea of Okhotsk. It is new to the Arctic.

Class Pelecypoda

Order Prionodesmacea

Suborder Taxodonta

Family Nuculidae

Genus *Nucula* Lamarck, 1799

Nucula tenuis (Montagu, 1808)

Var. *expansa* Reeve

Plate 18, figure 4

Arca tenuis Montagu, 1808, suppl., p. 56, pl. 29, fig. 1.
Nucula expansa Reeve, 1855, appendix, p. 397, pl. 33, fig. 2.
Nucula tenuis and var. *expansa* Soot-Ryen, 1932, p. 4, pl. 1, figs. 3, 4, 6.
Nucula tenuis Morris, 1951, p. 6, pl. 7, fig. 6.

Of the 96 specimens collected from 19 stations, over half came from depths of less than 125 feet. The highest yields were 17 from 118 feet, 14 from 120 feet (Aug. 8, 1949), 14 from 122 feet, 7 from 151 feet,

[12]For this synonymy I am indebted to Dr. S. Stillman Berry.

and 6 from 72 feet. Single specimens were taken at 246, 341, and 741 feet, and 2 specimens at 477 feet. (The last 2 stations were characterized by muddy bottom, as were the ones at less than 125 feet.) By means of dogteam dredging during the winter of 1950, 6 specimens were taken at 149 feet and 7 at 162 feet, where they had been "transplanted" by the storms of autumn. Six other stations yielded from 2 to 4 specimens each.

The majority of the specimens were over 10 mm. in length, the longest measuring 15.5 mm., the smallest about 6.7 mm.

Other material examined: Numerous specimens from the Alaskan Arctic, Siberia, the Aleutians, southern California, and Japan; Massachusetts, Greenland, the British Isles, Norway, and Spitzbergen.

Discussion: In the Point Barrow specimens there is marked variation in the degree of obeseness and some variation in the proportion of length to height. None of the specimens is exceedingly thin, but they undoubtedly all belong to the typical form and the var. *expansa* Reeve, with transitional forms.

In the specimens from Point Barrow the yearly growth lines (pl. 18, fig. 4) are often prominent and individuals from 11 to 14 mm. in length appear to be about 3.5, possibly 4.0, years old.

Distribution: *Nucula tenuis* is known from the western Arctic south to southern California, from the eastern Arctic south to North Carolina, and from north of Europe south to the Mediterranean.

Family Nuculanidae

Genus *Nuculana* Link, 1807

Nuculana minuta (Fabricius, 1776)

Plate 18, figure 3

Arca minuta Fabricius, 1776, p. 414.

Leda minuta G. Sars, 1878, p. 36, pl. 5, figs. 2a–b.—Oldroyd, 1924, p. 15, pl. 19, figs. 2, 2a.

Nuculana minuta Morris, 1952, p. 8, pl. 1, fig. 12.

Thirty-one living specimens were taken from 17 stations ranging in depth from 70 to 741 feet. Five specimens came from 741 feet, 4 from 477 feet, and 3 each from 295, 341, and 420 feet. The smallest specimen (from 741 feet) is 6.5 mm. in length; the largest (from 522 feet) is 16.5 mm. in length by 8.5 mm. in height by 5.7 mm. in breadth; the next largest (from 175 feet) is 15.6 by 8.4 by 5.3 mm.

Other material examined: Several specimens in the collection of the U. S. National Museum.

Discussion: I am indebted to W. K. Ockelmann of Copenhagen for identifying this species. The specimens from Point Barrow are less inflated and have a relatively longer rostrum than the specimens of

N. minuta that I examined; however, these differences come well within the normal limits of variation in this species.

DISTRIBUTION: Point Barrow, Alaska, south to San Diego, Calif., also to Japan. Madsen (1949) gives the Atlantic range as northeast America south to the Bay of Fundy; Greenland, Iceland, Spitzbergen, and along Norway and south to the English Channel.

Nuculana radiata (Krause, 1885)

PLATE 18, FIGURE 2

Leda pernula var. *radiata* Krause, 1885a, p. 23, pl. 3, figs. 2a–c.
Leda radiata Dall, 1921, p. 11.

A single live specimen, measuring 23.2 by 12.8 by 7 mm., was dredged at a depth of 80 feet on Aug. 21, 1948.

OTHER MATERIAL EXAMINED: None.

DISCUSSION: Although this specimen appeared to agree with the description and figures by Krause, I am indebted to W. K. Ockelmann for confirming the identification.

This species has high and prominent umbos, fewer hinge teeth than the smaller *N. minuta*, and a periostracum characterized by fine, dark, often broken, radiating ridges that cross the concentric ribs. Soot-Ryen (1932) states that no other species of *Nuculana* exhibits this curious radiating sculpture.

DISTRIBUTION: Soot-Ryen (1932) gives the range of this species as follows: Arctic Pacific: Chukchi and Beaufort Seas, Bering Strait and Sea, and the Sea of Okhotsk. Point Barrow represents a new locality.

Genus *Yoldia* Möller, 1842

Yoldia arctica (Gray, 1824)

PLATE 18, FIGURE 8

Nucula arctica J. Gray, 1824, p. 214.
Portlandia arctica G. Sars, 1878, p. 37, pl. 4, figs. 7a–b.
Leda arctica Oldroyd, 1924, p. 26, pl. 19, figs. 6, 6a.
Yoldia arctica Gardner, 1916, p. 518.—Morris, 1951, p. 9, pl. 41, fig. 11.

A single specimen, 13.9 mm. long by 8.7 mm. high by 5.6 mm. in breadth, was taken on Aug. 4, 1948, at a depth of 28 feet. The shell has a yellowish green periostracum, and apparently is either 3.5 or 4.5 years old.

OTHER MATERIAL EXAMINED: Over 60 specimens from Spitzbergen, Norway, and Arctic Canada (including about 30 specimens, mostly large, from Wellington Channel); 3 specimens from Collinson Point, Alaska; and about 40 specimens, labeled var. *lutescens*, collected by Captain Belcher from the "Arctic Ocean."

DISCUSSION: Specimens vary in color from olive green to brown to brownish black. There is also great variation in the degree of obesity

and in the degree of truncateness. In the var. *lutescens* the keel appears to be slightly higher near the umbos than in the typical form.

A specimen 16.5 by 10.7 by 6.9 mm. from the "Arctic Ocean" shows 7 distinct growth cessation lines (much darker than the surrounding areas of the shell) with a narrower secondary line between some of these; another, 20.1 by 13.6 by 9.8 mm., shows 9 distinct growth cessation lines with a few secondary lines; still another, only 15.9 mm. long, shows 11 or 12 nearly equally strong lines.

DISTRIBUTION: Collinson Point and Point Barrow, Alaska; Wellington Channel, Canada, south to Greenland; also Spitzbergen and Norway.

Yoldia myalis (Couthouy, 1838)

PLATE 18, FIGURE 1

Nucula myalis Couthouy, 1838, p. 62, pl. 3, fig. 7.
Yoldia myalis Gould, 1870, p. 160, fig. 467.—Oldroyd, 1924, p. 30, pl. 5, fig. 8.—Abbott, 1954, p. 340, pl. 27d.—Ockelmann, 1954, p. 18, pl. 1, fig. 5; pl. 2, figs. 5, 10.

Approximately 35 specimens were taken from 18 stations at depths ranging from 72 to 453 feet: 12 were taken from 213 feet, 1 from 453 feet, 1 from 295 feet, 1 from 246 feet, and 1 from 204 feet, the remainder coming from depths of less than 200 feet, with from 1 to 3 specimens per station.

OTHER MATERIAL EXAMINED: Over 100 specimens from localities ranging from Cape Smythe, Alaska, to the Aleutians, southeast Alaska, and Puget Sound; also over 25 specimens from Nova Scotia, Maine, and Massachusetts.

DISCUSSION: The fossette varies in depth and in shape, being short and triangular in some specimens and longer and narrower in others. The pallial sinus may be rounded or truncate at the anterior end and it may or may not be long enough to reach to a vertical line extended from the beaks. Some shells are much heavier than others.

DISTRIBUTION: From Point Barrow to Puget Sound; from Hudson Strait to Massachusetts.

Yoldia hyperborea Torrell, 1859 (*ex* Loven, MS.)

PLATE 18, FIGURE 5

Nucula hyperborea Loven, MS.
Yoldia hyperborea Torrell, 1859, p. 149, pl. 2, figs. 6a–b.—Odhner, 1910, p. 18, pl. 1, fig. 23.—Ockelmann, 1954, p. 8, pl. 1, figs. 1, 2; pl. 2, figs. 1–4.

About 14 living specimens and several valves were collected, the living ones as follows: 1 at 10 feet (Sept. 8, 1949), 1 at 70 feet, 1 at 72 feet, 1 at 80 to 100 feet (Aug. 21, 1948), 1 at 120 feet (Sept. 8, 1949),

5 at 132 feet, 1 at 134 feet, 2 at 141 feet, and 1 at 477 feet. The majority range between 25 and 35 mm. in length; the largest is 39.4 mm., the smallest is 13.9 mm.

Other material examined: One specimen from the Barents Sea, 13 from Spitzbergen, 7 from Norway, 1 from Iceland, 2 from Disco Bay, Greenland; 1 from Wellington Channel, Northwest Territories, Canada (about lat. 76° N.), 5 from off Beachy Island, Labrador, and 5 from 60 fathoms, Labrador, and 1 from Massachusetts Bay; approximately 50 from 18 stations from Kotzebue Sound to Plover Bay, to Norton Sound, to Kamchatka, St. Matthew Island, Nunivak Island and the Pribilofs; and 13 specimens (Stanford Collection) from deep water off Humboldt Bay, Calif.

Discussion: *Yoldia hyperborea* has not appeared in our Western literature because it has been identified with *Y. limatula* (see Morris, 1947, pl. 1, fig. 5; 1952, pl. 1, fig. 8), some authors considering the former merely an obtuse form of *Y. limatula* (Madsen, 1949, p. 20). One of the difficulties appears to be the great variation in the proportions of *Y. hyperborea.* Typical adult *Y. hyperborea* are about twice as long as high or even slightly less than twice as long as high, but other specimens may be more than twice as long as high. These latter specimens also have a more pointed posterior end than typical *Y. hyperborea,* leading to confusion with *Y. limatula* and sometimes with *Y. sapotilla* (see Abbott, 1954, pl. 27b).

Ockelmann (1954) has made an analytical study of these 3 species (and of *Y. myalis*) and as a result he erected a new subspecies of *Y. hyperborea,* which he named *limatuloides* (Ockelmann, 1954, pl. 1, fig. 2; pl. 2, fig. 2), characterized by the more pointed posterior end and the length being more than twice the height. He also listed distinguishing characteristics of the four species and the subspecies. Neither *Y. limatula* nor *Y. sapotilla* (see Ockelmann, 1954, pls. 1, 2) have a distinct sinuation in the anteroventral margin of the shell, whereas both *Y. hyperborea* and *Y. h. limatuloides* do have. In both *Y. limatula* and *Y. sapotilla* the umbo is slightly in front of the middle, but in *Y. hyperborea* and *Y. h. limatuloides* the umbo is somewhat behind the middle. In contrast to *Y. myalis,* all of these have a periostracum that appears varnished.

In most of the specimens from Point Barrow, the length slightly exceeds twice the height, but the excess is not so great as in *Y. h. limatuloides,* nor is the posterior end sufficiently pointed for this subspecies.

In color the Point Barrow specimens vary from an olive straw (those under 30 mm. in length) to a dark olive. The umbos and the areas surrounding them are usually lighter colored than the remainder

of the shell; this is especially marked in the larger, darker specimens (pl. 18, fig. 5).

The specimens I examined from north of the Pribilofs appear to be *Y. hyperborea* and, with the exception of the 13 specimens of this species from deep water off Humboldt Bay, those from south of the Pribilofs appear to be *Y. limatula*. Unfortunately, my examination and notes were made before Ockelmann's study was published, so that I cannot give separate ranges for typical *Y. hyperborea* and the subspecies *limatuloides*. However, I did examine typical *Y. hyperborea:* 11 from Spitzbergen, 1 from the Barents Sea, 10 from Labrador, 2 from 175 fathoms from Disco Bay, Greenland. Since the height was less marked than in typical *Y. hyperborea*, the specimens I examined from Norway, Iceland, and Massachusetts Bay may very well be the subspecies *limatuloides* or transitional stages between it and *Y. hyperborea.*

A specimen 40 mm. long from Spitzbergen has 8 or 9 growth cessation lines and several secondary lines, one 31 mm. long has 6 or 7 lines, and one 29 mm. long has 8 lines; one 32 mm. long from Bergen, Norway, has 6 or 7; and one 21 mm. long from the Wellington Channel has 6 or 8 lines.

DISTRIBUTION: Point Barrow south to the Pribilofs, and off Humboldt Bay; Wellington Channel, Jones Sound, Smith Sound, Labrador, and Massachusetts Bay; the eastern Siberian Ice Sea, the Kara Sea, Novaya Zemlya, the White Sea, the Murman Coast, the Barents Sea, Spitzbergen, Norway, Iceland, and Greenland.

Yoldia scissurata Dall, 1898

Yoldia scissurata Dall, 1898, p. 595.

One shell 31 mm. long by 17 mm. high was taken at 141 feet, and a left valve 23.5 mm. long by 12.5 mm. high was washed ashore on Aug. 21, 1949.

OTHER MATERIAL EXAMINED: Seven specimens from northern Japan and over 75 from localities ranging from Point Barrow south through Bering Sea and the Sea of Okhotsk to Bristol Bay, the Aleutians, Sitka Harbor, and the coast of Washington.

DISCUSSION: Grant and Gale (1931, p. 131) suggest that *Y. scissurata* Dall and *Y. ensifera* Dall are synonymous. I find the following differences between the two species: *Y. scissurata* is higher anteriorly and is proportionately longer from the umbos to the anterior end and proportionately shorter from the umbos to the posterior end than *Y. ensifera.* The posterior dorsal blades of the valves are longer and much higher in *Y. ensifera* than in *Y. scissurata,* so that a line from the beaks to the end of the rostrum always cuts across the blades in *Y. ensifera* but seldom does in *Y. scissurata.* The rostrum is more

upturned in *Y. scissurata*. Even in specimens only 5 to 10 mm. long, these differences are apparent and consistent.

A specimen 30 mm. long from the Sea Horse Islands has 7 or 8 growth cessation lines, one 23 mm. long has 6 or 7 lines; one 30 mm. long from the Shumagins has 6 or 8 lines, and one 25 mm. long has 5 or 6 such lines.

DISTRIBUTION: Point Barrow to Monterey Bay; and in the Pleistocene at San Pedro, Calif.

Suborder ISODONTA

Family PECTINIDAE

Genus *Chlamys* Röding, 1798

Chlamys islandica (Müller, 1776)

Pecten islandicus Müller, 1776, p. 248.—G. Sars, 1878, p. 16, pl. 2, fig. 2.—Oldroyd, 1924, p. 54, pl. 8, figs. 1, 2.—Morris, 1947, p. 18, pl. 11, fig. 7; 1951, p. 26, pl. 11, fig. 7.

Chlamys islandica Morris, 1952, p. 17, pl. 4, fig. 4.

This species was taken only sparingly. Because of marked variations in measurements, the specimens are listed in detail in table 4.

OTHER MATERIAL EXAMINED: Several entire shells and about 30 valves from localities ranging from Point Barrow through Bering Sea to the Aleutians and the Shumagins; about 15 shells and as many valves from Greenland, Labrador, Newfoundland, Nova Scotia. Maine; 2 from Vadsø, Norway, and 1 from Finmark, Norway.

DISCUSSION: These shells vary from light to heavy, and the sculpture varies from closely set, fine, rounded or inverted V-shaped, radiating ribs covered with closely set scales to broad, smoother, more widely spaced ribs, usually with a single secondary rib in the wide groove between the primary ribs (pl. 19, fig. 4). The primary ribs of the heavy shells characteristically divide, the resulting two ribs then continuing close together like a double rib. In some of the more highly sculptured specimens with prominent scales, three or more ribs may lie closely together, forming a ridge, with from one to three secondary ribs in the grooves between the ridges. One specimen from Vadsø resembles one from off Cape Cod and one from off Nova Scotia in that the ribs are scaly and tend to group into ridges. Except that the ribs are more closely set and scalier, another specimen from Vadsø resembles the Point Barrow specimens in having broad primary ribs that divide and in having a fine secondary rib between the primary ribs. Not all of the ribs in any one shell necessarily divide. A specimen from Massachusetts Bay resembles the Point Barrow ones more than specimens examined from Iceland.

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TABLE 4.—*Measurements, in millimeters, of* Chlamys islandica *(Müller) collected at Point Barrow, Alaska*

(Key: L, living; Sh, empty shell)

Date	Depth (in feet)	Length	Height	Breadth	Length of Hinge Line	Remarks
9–15–48	110	52. 0	62. 0	25. 0	27. 3	L
		72. 0	76. 0	29. 8	33. 9	Sh
9–15–48	120	7. 8	9. 2	2. 3	5. 3	L [1]
		66. 0	69. 0	28. 5	35. 0	L [2]
9– 9–48	125	71. 5	74. 0	31. 0	33. 5	L [3]
10–14–49	175	2. 2	2. 3	0. 8	1. 8	L
		11. 0	13. 0	3. 5	7. 4	Sh
		11. 2	13. 0	3. 5	7. 4	L
8–30–49	184	58. 0	61. 5	27. 5	29. 0	Sh
		61. 0	67. 5	24. 3	31. 0	Sh
10– 6–49	216	1. 3	1. 4	?	1. 2	L
		2. 1	2. 0	1. 7	1. 6	L
		2. 4	2. 5	1. 8	1. 8	L
10–11–49	341	71. 0	80. 0	31. 5	34. 0	L
8– 9–49	420	71. 0	76. 0	29. 5	35. 0	Sh [4]
		62. 0	65. 0	25. 0	30. 0	L
		62. 0	68. 0	25. 0	30. 0	L [5]
8–17–49	438	74. 0	78. 0	30. 0	35. 0	L [6]
8–17–49	522	72. 0	76. 5	30. 7	39. 5	L

[1] Among foliaceous bryozoans, and obviously grew in cramped quarters as the ventral edges were incurved so that the height was shortened, although there was little or no erosion.
[2] Among foliaceous bryozoans, and obviously grew in cramped quarters as the ventral margin was eroded and the ventral edges were incurved so that the height was shortened.
[3] This specimen has barnacles of four size groups growing on it (1 large, 6 medium, 6 or 7 small, and numerous tiny individuals), also several tunicates, an encrusting bryozoan, a species of *Barentsia*, colonies of hydroids, and several *Hiatella arctica* nestling around the barnacles.
[4] Compare with one from 125 feet.
[5] Convex at ventral margin.
[6] Compare with one from 522 feet.

The inside of the valves of the Point Barrow specimens tends to be white with sometimes some reddish purple color in the central portion showing through from the outside of the left valve, and occasionally with some of the same color around the edges. Shells examined from Bergen are largely apricot colored on the inside of the left valve and apricot and white on the inside of the right valve; a shell from Vadsø is apricot and purplish inside, and one from Finmark is apricot with a purplish muscle scar.

DISTRIBUTION: Jensen (1912) gives the range of this species as Labrador, western Greenland, Iceland, Spitzbergen, Barents Sea, entrance to Kara Sea (1 small specimen) but not within the Kara Sea (despite many dredgings), not in the Siberian Polar Sea nor Polar Sea north of Arctic America nor in the High-Arctic of eastern Greenland but in the Bering Sea and one specimen from the coast of Korea and one from the waters south of Vladivostok. In the Atlantic south to Cape Cod and western Norway.

The Point Barrow specimens extend the range into Arctic Alaska and those mentioned above extend it into the Aleutians and the Shumagins.

Suborder Dysodonta

Family Mytilidae

Genus *Mytilus* Linnaeus, 1758

Mytilus edulis Linnaeus, 1758

Mytilus edulis Linnaeus, 1758, ed. 10, p. 705.—Oldroyd, 1924, p. 66, pl. 27, fig. 4.

On Aug. 10, 1948, one right valve 60.6 mm. long and 31.7 mm. high was dredged at Eluitkak Pass, and on Oct. 1, 1949, a portion of a left valve was found on shore.

Other material examined: Numerous specimens from the western Atlantic and the eastern Pacific.

Discussion: The area under investigation was relatively small and in no place was there a suitable habitat for such tidal-zone animals as *M. edulis*. These shell fragments may have been transported by floebergs or by currents.

Distribution: World-wide in temperate waters; in the Pacific area from the Arctic (lat. 74° N.) to Cerros Island (lat. 28° N.) (Dall, 1921; Keen, 1937). Madsen (1949) gives the northern limit of this species as lat. 71° N. at Greenland and as Novaya Zemlya off Europe.

Genus *Musculus* Röding, 1798

Musculus niger (Gray, 1824)

Plate 18, figure 6; Plate 21, figure 6

Modiola nigra Gray, 1824, p. 244.
Modiolaria nigra Jensen, 1912, p. 63.—Oldroyd, 1924, p. 74, pl. 39, fig. 9.—Morris, 1947, p. 25, pl. 12, fig. 5; 1952, p. 45, pl. 6, fig. 4.
Musculus niger obesus Dall, 1916, p. 405.
Musculus niger Abbott, 1954, p. 355, pl. 28g.

The largest living specimen collected, 50 by 23.3 by 11.6 mm., was cast ashore on Oct. 17, 1949. If entire, a broken valve taken at Eluitkak Pass would have measured about 56 mm. long by 27.5 mm. high. In addition to those listed below, several juvenile specimens were dredged at 477 feet.

Eighteen living specimens were dredged: 2 (10.1 and 11.2 mm. in length) at Eluitkak Pass on Aug. 10, 1948; 4 (3.3, 8.2, 8.5, and 10.5 mm.) at Eluitkak Pass on Aug. 30, 1948; 2 (11.2 and 12.4 mm.) at 151 feet; 2 (10.1 and 11.2 mm.) and 1 (30.2 by 16.5 by 8.5 mm.) at 204 feet; 1 (7.2 mm.) at 213 feet; 1 (7.2 mm.) at 216 feet; 1 (7.3 mm.) at 217 feet; 1 (12.5 by 7.3 by 4.4 mm.) at 341 feet; 1 (9.8 mm.) at 477 feet; and 2 (8.3 and 31.5 mm.) at 741 feet.

Other material examined: Over 30 specimens from localities ranging from Bernard Harbor, Northwest Territories, Canada, and from near the mouth of the Colville River to Point Barrow and Icy

Cape, and south to Nunivak Island, the Aleutians, and Puget Sound; about 6 specimens (including the figured type) from the Shetlands, the British Isles, and Norway; and about 85 specimens from Greenland, Labrador, Maine, and south to Cape Hatteras.

Discussion: The young of this species are olive green to brown and occasionally creamy tan; larger specimens vary from olive green to brown to black, with various mixtures of these colors—for instance, the center may be black and the anterior and posterior ends brown. There is some variation in the coarseness of the striae. The shells also vary in breadth from thin to relatively obese, the latter giving rise to Dall's *M. niger obesus*. There are all intergradations between the thin and the obese. In specimens from northwest Greenland, Grand Manan, Long Island Sound, and Isle au Haut, Maine, there are both thin and obese shells. Specimens from the north end of Nunivak Island vary from medium thin to obese.

A specimen 66 mm. in length from the north of Unimak Island has about 13 growth cessation lines, plus several secondary lines, one 37 mm. in length has from 7 to 9 growth cessation lines; and 2 specimens from west of the Colville River, measuring 49 mm. and 56 mm. in length, have 11 and 15 lines, respectively.

Distribution: Throughout the Arctic; in the Pacific south to Oregon; in the Atlantic south to Cape Hatteras, N. C., and to Scotland.

***Musculus corrugatus* (Stimpson, 1851)**

Plate 4, figure 11; Plate 18, figure 7; Plate 21, figure 4

Mytilus corrugatus Stimpson, 1851, p. 12 [no description but "=*Modiola discors* Gould"].

Modiolaria corrugata G. Sars, 1878, p. 30, pl. 19, figs. 2a–b.—Jensen, 1912, p. 62, pl. 3, figs. 7a–d.

About 40 specimens, mostly small, were dredged: 1 (17.8 by 10.9 by 6.9 mm.) from Eluitkak Pass on Aug. 1, 1950; 3 (4, 4.5, and 13.8 mm. long) from 130 feet on Aug. 9, 1949; 2 (5 and 12.7 mm.) from 184 feet; 1 (7.3 mm.) from 204 feet (pl. 4, fig. 11); 2 (8.6 and 12 mm.) from 213 feet; 2 (6 and 6.5 mm.) from 216 feet; 6 (from 3.5 to 10.5 mm.) from 217 feet; 2 (8.6 and 13.2 mm.) from 295 feet; 1 (13 mm.) from 341 feet; 17 (from 3.5 to 14.2 mm.) from 420 feet; 1 (13 mm.) from 438 feet; and 3 (5.8, 10.5, and 14.5 mm.) from 741 feet.

Other material examined: 4 specimens from "north of Bering Strait," 2 from Bernard Harbor, 3 from Dolphin and Union Straits.

Discussion: The Point Barrow specimens vary in color, from a very pale greenish to an olive green, in the degree of inflation, and in the extent to which the basal margin of the posterior striated portion projects below the unstriated middle portion (pl. 18, fig. 7). There

is little evidence of this projection in specimens 8 mm. and less in length (pl. 4, fig. 11; pl. 21, fig. 4).

A specimen with a shell measuring 12.7 by 6.9 by 6 mm. that was taken at 184 feet on Aug. 30, 1949, was entirely enclosed within a byssal capsule, and within this capsule were a large number of embryonic clams still within their egg membranes but with definite valves developed. The egg membrane was from 20 to 55μ longer than the embryonic clams. Two of the embryos measured 389μ (434μ with the egg membrane), 5 measured 434μ (1 was 454μ long with the egg membrane), and 1 measured 462μ.

A specimen 13 mm. long is at least 3 years old.

DISTRIBUTION: Circumboreal. Arctic Ocean to Puget Sound (Dall, 1921); Jan Mayen (?), western Greenland (few), Iceland (?), Spitzbergen, Finmarken, Polar Sea of Siberia (Jensen, 1912); Greenland to North Carolina (Johnson, 1934).

Musculus discors (Linnaeus, 1767)

Var. *laevigatus* and forma *substriatus* Gray

PLATE 18, FIGURE 10; PLATE 21, FIGURE 5

Mytilus discors Linnaeus, 1767, ed. 12, p. 1159.
Modiola laevigata Gray, 1824, p. 244.
Modiola laevigata var. *substriata* Gray, 1824, p. 245.
Modiolaria laevigata G. Sars, 1878, p. 29, pl. 3, figs. 3a–b (good illustrations).
Modiolaria discors Jensen, 1912, p. 57, pl. 3, figs. 6a–b.
Modiolaria discors var. *laevigata* Jensen, 1912, p. 57, pl. 3, figs. 4a–b.
Modiolaria discors var. *substriata* Jensen, 1912, p. 58, pl. 3, figs. 5a–c.
Musculus discors Abbott, 1954, p. 355, pl. 28e.
Musculus laevigatus Abbott, 1954, p. 355, pl. 28f.

Varieties of this species, especially individuals up to 9 mm. in length, were fairly abundant in the deeper stations. The largest individual, 29 mm. long, came from 741 feet; 1 (21 mm.) came from 477 feet; 1 (14 mm.) from 453 feet; 2 (20 and 24.5 mm.) from 438 feet; 1 (24.6 by 16.1 by 9.4 mm.) from 175 feet; 1 (13 mm.) from 122 feet; 1 (28.9 mm.) from Eluitkak Pass on Aug. 1, 1950; 11 (from 7.6 to 11.2 mm.) from Eluitkak Pass on Aug. 30, 1948; and 3 (11.5, 16.5, and 23 mm.) from Eluitkak Pass on Aug. 6, 1948.

Smaller individuals were dredged as follows: 4 (up to 5 mm.) at 130 feet on Aug. 9, 1949; 1 (about 3 mm.) at 152 feet; 5 (up to 11 mm.) at 175 feet; 3 (up to 6 mm.) at 184 feet; 1 (3 mm.) at 420 feet; about 30 (up to 9 mm.) at 438 feet; 8 (up to 13.5 mm.) at 453 feet; about 100 (from 2 to 13.2 mm.) at 477 feet; and 18 (from 3 to 15.5 mm.) at 741 feet.

Juveniles up to 9 mm. in length were frequently found attached to erect colonies of bryozoans. For example, 3 specimens (up to 6 mm. long) were found attached to *Tricellaria erecta* at 184 feet; 1 (10 mm.)

was found nestled in *Barentsia gorbunovi* at 341 feet; about 30 (up to 9 mm.) were attached to *B. gorbunovi* at 438 feet; and a small individual was found nestled in the tunic of *Boltenia echinata*.

Most of the larger individuals were encased in a capsule of byssal threads, but no individual less than 13.5 mm. long was found in a byssal capsule. In one encapsuled specimen (20.4 by 12.6 by 8.1 mm.) from Eluitkak Pass, stolons of hydroids were interlaced through the byssal threads and among this network were nestled a *Hiatella arctica* 6.6 mm. long, an annelid worm about 7 mm. long, and 2 sipunculids, *Golfingia margaritacea*, about 5 and 7 mm. long. One specimen 22.5 mm. long that was taken from 328 feet was in a capsule that was covered with a colony of the bryozoan *Dendrobeania murrayana*, which, in turn, provided space for colonies of 2 other bryozoans, 2 species of hydroids, some sponges, foraminifers, and a *Hiatella arctica* 5.8 mm. long.

Another specimen 22.4 mm. long from 328 feet (Sept. 1, 1949) was encased in a byssal net to which were attached colonies of a bryozoan, and attached to this mass was a *Musculus discors* var. *laevigatus* 2.2 mm. long and another smaller one. A large encapsuled individual was taken at 341 feet. The smallest encapsuled individual (13.5 mm.) taken at 453 feet, was attached to the stalk of the tunicate *Boltenia ovifera*. Two others (15 and 17.5 mm. long) from 453 feet were in capsules to which were attached colonies of *Barentsia gorbunovi* and *Eucratea loricata* with their attached fauna. Two (19.5 and 21 mm.) from 477 feet were in capsules matted with nematodes, and tiny sponges and small colonies of *Eucretea loricata* were attached to one of the cases. Only a portion of these capsules was opened, but no eggs were found in those examined.

Other material examined: About 50 specimens from localities ranging from Bernard Harbor, Northwest Territories, and Icy Cape, Alaska, south and east to the Aleutians and Puget Sound; and over 75 specimens from localities ranging from the Melville Peninsula and Greenland to Connecticut, and from Spitzbergen and Norway. (Two from between Bristol Bay and the Pribilofs and one from Sitka Harbor were in byssal capsules.)

Discussion: There has been considerable difference of opinion regarding this species and its varieties. Jensen (1912) has shown that *M. laevigatus* Gray and *M. substriatus* Gray are not distinct species. The former is a variety of *M. discors* (see Jensen, 1912, pl. 3, figs. 6a–b) in which the posterior striations are lacking (Jensen, 1912, pl. 3, figs. 4a–b) and *M. substriatus* is merely a form of var. *laevigatus* in which the posterior striations are visible but faint (Jensen, 1912, pl. 3, figs. 5a–c). In true *M. discors* the posterior striations are distinct, as in *M. corrugatus* (Jensen, 1912, pl. 3, figs. 7a–d), but in *M. discors*

and its varieties the central portion of the shell between the posterior and anterior striations is much smoother (pl. 18, fig. 10) than in *M. corrugatus;* in the former the periostracum of this central area has delicate, simple, transverse lines but in *M. corrugatus* it is wrinkled and shagreen-like. In adults, both the posterior and anterior striations are more numerous in *M. niger* than in the other two species, and the posterior striations of *M. corrugatus* are more numerous than those of *M. discors* var. *laevigatus* f. *substriatus.*

Color, on which certain varieties and species have been based in the past, is a very unreliable characteristic in this group. In the specimens examined, all gradations of color from a pale olive green through browns to a shiny black (Plover Bay) were found. Several are a mixture of brown and black. Very young specimens from Point Barrow are a pale yellowish green.

Juvenile specimens of *M. discors* and its varieties are difficult to separate from those of *M. corrugatus* and *M. niger*, for all of them have both anterior and posterior striations on the shells. The young of *M. discors* var. *laevigatus* are usually more inflated than those of *M. corrugatus*, and the latter are more inflated than those of *M. niger.* The umbos of juvenile *M. corrugatus* are prominent (pl. 21, fig. 4). The ventral margin of juvenile *M. corrugatus* is fairly straight (pl. 21, fig. 4), that of *M. niger* is somewhat convex (pl. 21, fig. 6), while that of *M. discors* var. *laevigatus* is somewhat more arcuate and the first posterior striation projects somewhat (pl. 21, fig. 5). The dorsal margin of juvenile *M. niger* ascends posteriorly more rapidly from the umbos (pl. 21, fig. 6) than in *M. discors* var. *laevigatus* (pl. 21, fig. 5).

The degree to which the posterior striations fade out in the varieties of *M. discors* as growth proceeds farther from the umbos is highly variable. Some shells were observed in which no indication of striations could be seen beyond the first year growth line and in others the striations persisted, though less marked, to the second year growth line. In others faint striations could be seen in adult specimens and in a few the striations fade out in the middle portion of the posterior end and appear again near the margins.

The Point Barrow specimens belong to the var. *laevigatus* and a few of them could be assigned to the forma *substriatus.* This substantiates Jensen's (1912) statement that he has not found a true *M. discors* in the Arctic. I am indebted to Dr. Thorson and Mr. W. K. Ockelmann for sending me specimens of true *M. discors*, *M. discors* var. *laevigatus*, and *M. discors* var. *laevigatus* forma *substriatus*, as well as specimens of *M. corrugatus.*

Thorson (1935) states that in eastern Greenland *M. discors* var. *laevigatus* draws together blades of *Fucus* or *Laminaria* by means of

byssal threads and thus encased with the seaweed and byssal threads lays a string of eggs that develop into young clams within the seaweed-byssal "nest." At Point Barrow there are no seaweeds that could be used in this manner and the animal makes its capsule entirely of byssal threads. I examined 3 specimens of var. *laevigatus* from the northeast end of the Melville Peninsula and 3 from the south end that were in byssal nests with pieces of *Ulva*-like alga attached.

The Pacific specimens of varieties of *M. discors* usually have been listed under the specific names of *Modiolaria laevigata* and *M. substriata* by Western authors.

Distribution: Varieties of *M. discors* are found throughout the Arctic and as far south as Japan and Puget Sound in the Pacific and New York and Madeira in the Atlantic. As at Point Barrow, the var. *laevigatus* is more common in both eastern and western Greenland and in Iceland than the forma *substraitus* (Jensen, 1912; Madsen, 1949).

Order Anomalodesmacea

Family Thraciidae

Genus *Thracia* Blainville, 1824

Thracia myopsis (Möller, 1842, *ex* Beck MS.)

Plate 23, figure 9; Plate 24, figure 4

Thracia myopsis Möller, 1842a, p. 18; 1842b, p. 94.—Soot-Ryen, 1941, p. 38, pl. 2, figs. 1–4; pl. 6, figs. 3a–b; pl. 8, figs. 4a–e.
Thracia curta Dall, 1921, p. 25 (in part).—Oldroyd, 1924, p. 84 (in part).

One right valve 30.5 mm. long and 24.3 mm. high was taken at 217 feet, and 1 entire (only recently vacated) shell 30 mm. long and 22.5 mm. high was taken at 341 feet.

Other material examined: A number of specimens from Icy Cape, Cape Sabine, Plover Bay, off Bristol Bay, Amchitka Island, Atka Island, and Port Etches (all of which were labeled *T. curta*). Also several specimens (labeled *T. myopsis*) from Bergen and Vadsø, Norway, from Spitzbergen, and from Greenland and Maine.

Discussion: The Point Barrow specimens correspond with those examined from Bergen and Vadsø. Those from Greenland and Spitzbergen are a trifle more elongate, a trifle more angular, and somewhat more abruptly truncate. The specimens from Maine are somewhat higher and more truncate and have a somewhat shorter posterior end.

In examining specimens of *Thracia*, it was found that those from Port Etches and northward are *T. myopsis* and those from Lituya Bay and Sitka and on south are *T. curta* Conrad. The northernmost range of *T. curta* thus becomes Lituya Bay (about lat. 58.5° N. instead of lat. 71° N.). In *T. curta* the beaks are more posteriorly placed and

there is more inequality of the valves than in *T. myopsis*. There is also more of a dip in the anterodorsal margin in *T. curta* than in *T. myopsis*.

DISTRIBUTION: Point Barrow south to the Aleutians and Port Etches (about lat. 60.3° N., long. 146.3° W.), also Plover Bay, Siberia. Madsen (1949) gives the Atlantic range of *T. myopsis* as northeastern America south to Massachusetts; Greenland; Iceland, Norway north of Bergen, and Spitzbergen to the Kara Sea. It is new to the Pacific and the Pacific area of the Arctic.

Thracia (*Lampeia*), new subgenus

TYPE SPECIES: *Thracia adamsi*, new species.

Shell small, inequivalve, ovately-subquadrate, rounded anteriorly, broadly truncate posteriorly, anterior end longer than posterior, right valve higher and more convex than left; ligament external, thin; hinge edentate; resilium large, elongate-trigonal; with a large buttressed resilifer tapering posteriorly beneath the beaks.

The buttressed resilifer distinguishes this group from others of the family.

REMARKS.—This subgenus probably belongs close to subgenus *Thracia* (*Thracia*). It is named in honor of Mr. Chester Lampe, head Eskimo employee at the Arctic Research Laboratory, Point Barrow base, Alaska.

Thracia adamsi, new species

PLATE 18, FIGURE 9; PLATE 21, FIGURES 7, 8; PLATE 24, FIGURE 8

Shell small, white, inequivalve, right valve higher and deeper than left; covered with a fairly thick brown periostracum; beaks directed posteriorly; posterior end the shorter, broadly subtruncate, with a faint radial ridge bearing along the lower two thirds a few microscopic spinelets and a suggestion of a second row of spinelets midway of the area posterior to the ridge; anterior end obtusely rounded; ventral margin only slightly convex; periostracum smooth in center and finely wrinkled near the margins; sculpture of faint concentric lines of growth; ligament external, thin; resilium large, elongate-trigonal; a large, elongate-trigonal resilifer extending in an obliquely posterior direction from the beaks, solidly attached to the shell throughout its length except near its anteroventral margin where it is buttressed by about 15 short pillars separated by shallow pits of about the same width as the pillars, and separated from the anterodorsal edge of the shell by a large, deep pit. Interior of shell chalky; posterior adductor muscle scar large, rounded; anterior, large, elongate. Central portion of pallial line somewhat wavy; pallial sinus of medium size, broadly

U-shaped in the left valve, rounded and somewhat larger in the right valve; lower edge of pallial sinus scar not confluent with pallial line.

DIMENSIONS: Holotype, closed shell, length, 22.8 mm., height, 18.1, depth, 9.19; right valve, height, 18.3 mm., depth, 6.1; left valve, height, 17.3 mm., depth, 4.4.

REPOSITORY: Holotype in U. S. National Museum, No. 610301.

TYPE LOCALITY.—About 2.5 miles off Point Barrow base, Alaska. Depth, 110 feet. Bottom: stones, mud, gravel (haul containing many *Psolus fabricii* (sea cucumber) and sea anemones, mostly *Stomphia coccinea*). Collected by G. E. MacGinitie, Sept. 15, 1948.

REMARKS: Although this shell was empty, the right valve had apparently been drilled only recently. The posteroventral margin is somewhat shortened by breakage. This species is named in honor of Mr. Max Adams, an Eskimo who served G. E. MacGinitie as head boatman during the summer of 1948.

Family LYONSIIDAE

Genus *Lyonsia* Turton, 1822

Lyonsia norvegica (Gmelin, 1790)

Mya norvegica Gmelin, 1790, p. 3222.
Mya striata Montagu, 1815, p. 188, pl. 13, figs. 1 and A.
Lyonsia norvegica Jeffreys, 1865b, p. 29, pl. 2, fig. 1 (good illustration).

One specimen with a shell 36.3 mm. long and 19.4 mm. high was taken at 420 feet. It appeared to be about 2½ years old. A portion of a valve 17.4 mm. high was taken at 328 feet.

OTHER MATERIAL EXAMINED: Over 100 specimens from the Shetlands, Ireland, the Hebrides, and the Mediterranean.

DISCUSSION: The Point Barrow specimens are less transparent than the other material examined. (Several species of shells from Point Barrow are more chalky and less transparent than the same species from other localities.)

DISTRIBUTION: Point Barrow south to Juan de Fuca Strait; from Lofoten, Norway, south to the Mediterranean, from the Shetlands, the Faroes, and Iceland.

Order TELEODESMACEA

Suborder DIOGENODONTA

Family ASTARTIDAE

Genus *Astarte* Sowerby, 1816

Species in this genus are extremely variable, with the result that some of them have been redescribed many times and endless varieties have been named, these species and varieties being based on such

highly variable characters as color and the relative coarseness of concentric ribs. Both Lamy (1919) and Dall (1903a) made revisions of this genus, but Lamy did not have access to many of the Pacific species, and Dall, like the present writer, did not have access to many European species; and by the time their revisions were made the species were so hopelessly confused in the literature that the only way to straighten them out would be to see the specimens on which the various papers were based. Jensen's work (1912) on several species was an excellent contribution.

Astarte borealis Schumacher, 1817

PLATE 22, FIGURES 1–6

Astarte borealis Schumacher, 1817, p. 47, pl. 17, fig. 1.—Dall, 1903a, pp. 941, 944.—Jensen, 1912, p. 92, pl. 4, figs. 1a–f.—Soot-Ryen, 1939, p. 10, pl. 1, figs. 1–3.—Morris, 1952, p. 33, pl. 8, fig. 21.—Abbott, 1954, p. 375, pl. 28q.—Kira, 1954, p. 105, pl. 52, fig. 22.
Astarte arctica Möller, 1842a, p. 20; 1842b, p. 93.
Astarte semisulcata Möller, 1842a, p. 19; 1842b, p. 92.
Astarte richardsoni Reeve, 1855, p. 397, pl. 33, figs. 7a, b.

Approximately 40 specimens (including empty shells) were dredged. About one half of this number came from Eluitkak Pass and at least half of them were empty shells. The remaining specimens and shells came from 11 stations ranging in depth from 80 feet (Sept. 8, 1948) to 438 feet. With the exception of the station at 295 feet, with 5 specimens, no station other than Eluitkak Pass yielded more than one or two. The largest living specimen (54 mm. long by 43 mm. high by 20.4 mm. in breadth) came from Eluitkak Pass; two other shells from Eluitkak Pass and 1 from 295 feet exceed 50 mm. in length, and at least 22 others exceed 40 mm. in length. The 3 smallest specimens are: 1 (14.5 by 11.5 by 5.4 mm.) from 118 feet; 1 (13 by 11 by 10 mm.) from 341 feet; and 1 (17.5 by 13 by 6 mm.) from 295 feet. The complete absence of very small specimens is worthy of note.

Empty shells were usually filled with mud and were so tightly closed that it was impossible to distinguish empty from living shells without opening them. Since the umbos of living shells were often as worn and eroded as those of dead shells, the external appearance was no criterion.

OTHER MATERIAL EXAMINED: Over 100 specimens from the following localities: Franklin Bay, Icy Cape, Plover Bay, Bering Sea, and the Kudobin Islands; Wellington Channel, Cumberland Gulf, the Grand Banks, and Labrador; and Novaya Zemlya.

DISCUSSION: The Point Barrow shells vary in color from light brown to black, sometimes with combinations of the two colors in the same shell. Some, even living ones, have a rustlike deposit or con-

cretion on portions of the shell, especially the anterior end. There is great variation in the proportion of the length to the height, and in the general shape of the shell: 1 (44.8 by 35 by 14 mm.) from Eluitkak Pass is typical in both shape and dimensions; another (40.8 by 31.9 by 12.6 mm.) from Eluitkak Pass (Aug. 1, 1950) is an elongate shell in which the posterior end is more pointed and extended than usual (pl. 22, fig. 6); still another (42.3 by 36.7 by 12.6 mm.) from Eluitkak Pass (Aug. 10, 1948) has both anterior and posterior ends, as well as the ventral margin, slightly more rounded than usual (pl. 22, fig. 2). In another specimen (40.6 by 34.4 by 17.1 mm.) from Eluitkak Pass the posterior end is shortened and truncated, the result of habitat and the vicissitudes of life, and the umbos are completely eroded away. In a specimen from 152 feet the shell is box-like along the ventral margin (also see *Cardita crassidens*). Some of the variations in shape and proportions are shown by Soot-Ryen (1939, pl. 1, figs. 1–3), and variations in sculpture as well as shape are described and figured by Jensen (1912, pl. 4, figs. 1a–f).

In many of the shells the concentric ribs around the umbos do not continue for more than 7 or 8 mm. before being replaced by fine concentric lines, but in others these ribs may extend toward the ventral margin for a distance of 12 mm. or more. In most the transition from ribs to fine lines is abrupt, but in some it is less marked.

The hinge is also a highly variable character, the teeth and fossae vary in size and shape, and minor protuberances may be present or absent. The chalkiness characteristic of many Arctic shells often makes the teeth appear large and coarser than usual. Ridges, depressions, and fossae on the inside of the shell also vary greatly in size and shape.

Shells examined from other localities exhibit the same variations as the ones from Point Barrow, many having the convex lower border, others with the posterior end produced, and others with a shortened posterior end. Shells from the same locality may exhibit all of these variations, or in any combination, and all types of intergrades are found.

Growth cessation lines are indistinct in this species, but shells from 45 to 50 mm. long are probably from 6 to 8 years old.

Distribution: MacFarlane Bay near the mouth of the Mackenzie River, Point Barrow, south to the Aleutians and Prince William Sound, the Sea of Okhotsk, also northern Japan; in the Atlantic area south to Massachusetts and Rhode Island; Greenland and Iceland; Franz Josef Land, Novaya Zemlya, and northern Europe south to Bergen, Norway.

Astarte montagui (Dillwyn, 1817)

Varieties

PLATE 22, FIGURES 11–16

Venus compressa Montagu, 1808, suppl., p. 43, pl. 26, fig. 1. [Preoccupied.]
Venus montagui Dillwyn, 1817, p. 167.
Nicania banksii Leach, 1819, appendix 2, p. 62.
Nicania striata Leach, 1819, appendix 2, p. 62.
Astarte striata J. Gray, 1839, p. 152, pl. 44, fig. 9.
Astarte banksii J. Gray, 1839, p. 152, pl. 44, fig. 10 (= f. *warhami*).
Astarte globosa Möller, 1842a, p. 19.—Reeve, 1855, p. 398, pl. 33, figs. 6a–b.
Astarte pulchella Jonas, 1845, *in* Philippi, 1844–1847, p. 60, pl. 1, *Astarte*, fig. 12.
Astarte warhami Hancock, 1846, p. 336, pl. 5, figs. 15, 16.
Astarte fabula Reeve, 1855, p. 398, pl. 33, figs. 5a–b.—Oldroyd, 1924, p. 107, pl. 19, figs. 4, 4a.—Morris, 1952, p. 33, pl. 8, fig. 22.
Astarte montagui Jensen, 1912, p. 97, pl. 4, figs. 2a–c.

After *Hiatella arctica*, and possibly *Macoma calcarea*, this was the most abundant bivalve collected at Point Barrow. It was taken at depths of 80 to 741 feet. The most important collecting data are given below:

Three individuals (from 18.2 to 22.5 mm. in length) were dredged from 80 feet (Aug. 21, 1948); 7 (from 18.8 to 24.2 mm.) from 120 feet (Aug. 8, 1949); 9 (from 9.3 to 20.7 mm.) from 138 feet; 10 (from 7.7 to 20.2 mm.) from 149 feet; 13 (10 from 7.3 to 10.8 and 3 from 16.5 to 20.6 mm.) from 162 feet; 7 (from 12.9 to 24.1 mm.) from 204 feet; 12 (from 7.4 to 26 mm.) from 216 feet; 38 (from 5.5 to 26.7 mm.) from 217 feet; (from 12.1 to 35 mm.) from 246 feet; 12 (from 16.9 to 25.2 mm.) from 295 feet; 32 (from 10.1 to 25.5 mm.) from 341 feet; 25 (from 10.2 to 24.4 mm.) from 420 feet; 40 (from 11.9 to 24.4 mm.) from 453 feet; and 8 (from 6.5 to 16.6 mm.) from 741 feet.

OTHER MATERIAL EXAMINED: Over 20 specimens (labeled *A. fabula*) from localities ranging from Icy Cape to British Columbia.

DISCUSSION: Jensen (1912) separated the varieties of *A. montagui* by the statistical method. In his selected types, the height divided by the length in forma typica gave 92.9 percent; in var. *striata*, 86.7 percent; and in var. *warhami*, 76.1 percent. The breadth divided by the length in forma typica gave 53.6 percent; in the var. *striata*, 53.3 percent; in the var. *warhami*, 43.2 percent; and in the var. *globosa* percentages in the 60's. Although the height : length percentages range in the 90's in forma typica, in the 80's in var. *striata*, and in the 70's in var. *warhami*, there is no sharp dividing line and some shells could as easily be assigned to one variety as to another. Jensen (1912) states ". . . it must be remembered that all possible transitional stages exist between the forms mentioned."

Jensen (1912) writes that var. *striata* is by far the most predominant form at western Greenland, with var. *globosa* occurring frequently, the typical form and var. *warhami* being comparatively rare. He also states that *A. montagui* "becomes elongated on the whole in the same degree as the marine climate becomes more severe," the typical form being found in the Faroes and southwest Iceland, the var. *striata* beginning to appear at the northern end of western Iceland; at western Greenland the var. *striata* predominates and the more elongate *warhami* begins to appear, whereas at eastern Greenland the var. *warhami* is almost the only form.

The findings at Point Barrow agree with Jensen's observations, for the great majority of the *A. montagui* from there belong to the var. *warhami* Hancock (pl. 22, figs. 11, 12) and there are no true forma typica. A much lesser number can be assigned to the var. *fabula* Reeve, a few to the var. *striata* Leach (see pl. 22, fig. 14), and one or two approach the dimensions of var. *globosa* Möller. The largest specimen, from a depth of 246 feet, measures 35 by 29.6 by 17.1 mm. It has the periostracum of *A. montagui* and the shape of var. *striata* but the shell is exceptionally large for either the typical form or the variety. The next largest is a var. *warhami* measuring 27.2 by 21 by 11.4 mm. Jensen found that accompanying the elongation of the form there is an increase in maximum length from around 19–20 mm. at the Faroes and western Iceland to 23–26 mm. at eastern Iceland and Greenland. The majority of the larger specimens from Point Barrow come within the 23–26 mm. range. Specimens from any large haul usually have representatives of the varieties *warhami*, *fabula*, and *striata*, with intergrades (pl. 22, figs. 15, 16).

There is as much variation in sculpture as in shape. The most common sculpture consists of prominent, evenly spaced, concentric riblets (with about equal interspaces) in the umbonal region, with less prominent, irregularly spaced, concentric riblets throughout the lower two thirds of the shell or with fine lines that give the shell a smooth appearance, but in some shells the umbonal sculpture extends to the ventral margin, and in others the umbonal sculpture is only slightly more prominent than that throughout the remainder of the shell.

The color ranges from a yellowish tan to a dark chestnut brown. In some shells a black deposit covers part or sometimes nearly all of the periostracum. The latter sometimes cracks and peels away from the shell and the shell itself sometimes cracks.

Like *A. borealis*, this species closes so tightly that it is difficult to insert a razor blade between the valves.

Yearly age lines are not so conspicuous in this species as in some of the other Point Barrow shells. A shell 7.3 mm. long appears to be

from 1 to 2 years old; one 10.8 mm., about 2 years; one 16.5 mm., about 4 years; and one 20.6 mm., about 5 years old. There is some evidence indicating that if a large series were available from one locality, they could easily be sorted into age groups on the basis of size.

In the specimens taken at 453 feet on Oct. 11, 1949, the females greatly outnumbered the males. The females contained eggs that were not quite mature, measuring about 292μ, including the membrane. Of 9 specimens taken through the ice at 162 feet on Feb. 18, 1950, 3 were so immature that the sex could not be determined without making sections, 4 were males with fairly well developed testes, 1 had immature eggs, and 1 had some fairly well developed eggs. Six of the eggs from the latter specimen measured 324, 316, 291.5, 283.4, 283.4, and 234.9μ, an average of 288μ; the yolk portion measuring from 105.3 to 218.7μ, and averaging 162μ.

This species forms a favorite food of *Natica* and *Polinices* and drilled shells are common in dredge hauls.

Distribution: *A. montagui* occurs in all Arctic seas; in the Pacific as far south as British Columbia; in the western Atlantic as far south as Massachusetts, and in the eastern Atlantic as far south as the Bay of Biscay. Point Barrow is a new locality. This is a new name in our list of Pacific mollusks.

Family Carditidae

Genus *Cardita* Lamarck, 1799

Cardita crebricostata (Krause, 1885)

Cardita borealis var. *crebricostata* Krause, 1885a, p. 30, pl. 3, fig. 4.
Venericardia alaskana Dall, 1903b, pp. 710, 715; 1903a, pl. 63, fig. 7.
Venericardia crebricostata Oldroyd, 1924, p. 114, pl. 13, fig. 12.

Two worn right valves, measuring 27.2 mm. long by 24.5 mm. high, and 29.6 by 25.9 mm., were taken at 140 feet on Aug. 21, 1949, and a somewhat broken valve was washed ashore.

Other material examined: All the specimens in the U. S. National Museum labeled *V. alaskana* and *V. crebricostata.*

Discussion: With the exception of 3 specimens from the vicinity of Monterey, all of the specimens labeled *C. alaskana* are *C. crebricostata.* Specimens from Puget Sound and the coast of Oregon conform to the specifications for *C. crebricostata,* but those from Monterey are probably *C. ventricosa.*

Distribution: Point Barrow south and east to the Aleutians, British Columbia, Puget Sound, and the coast of Oregon.

Cardita crassidens (Broderip and Sowery, 1829)

PLATE 22, FIGURES 7–10

Astarte crassidens Broderip and Sowerby, 1829, p. 365.
Cardita borealis var. *paucicostata* Krause, 1885a, p. 30, pl. 3, fig. 5.
Venericardia crassidens Dall, 1903a, p. 949, pl. 63, fig. 9.
Venericardia paucicostata Oldroyd, 1924, p. 112, pl. 13, fig. 3.—Kira, 1954, p. 105, pl. 52, fig. 21.

Approximately 35 specimens were collected from 18 stations ranging in depth from 80 to 477 feet; the greatest number from any one station was 8 from 341 feet. The largest shell measures 36.4 mm. long by 37.2 mm. high by 18.9 mm. in breadth, and the next largest is 35 by 38 by 17.8 mm. Other than the smallest specimens, the majority range between 20 and 35 mm. in height. Small specimens were collected as follows: 1 (3.5 by 3.2 by 1.9 mm.) from 216 feet; 3 (ranging from 1.6 to 2.2 mm. in length) and 1 (3.3 by 3 by 1.8 mm.) from 184 feet; 1 (4.6 by 4.4 by 2.5 mm.) from 152 feet; and 4 (2.4, 3, 8, and 9.1 mm.) from 341 feet.

The gonads of a specimen collected at 341 feet on Oct. 11, 1949, contained eggs measuring up to 761.4μ (the average being 753μ). Since there was only a thin, crystalline layer around the egg, most of the egg consisted of yolk. With such a large, yolky egg, it seems probable that *C. crassidens* is ovoviviparous.

OTHER MATERIAL EXAMINED: About 25 specimens from localities ranging from Icy Cape and the Sea Horse Islands, Bering Strait and Plover Bay to Kodiak Island.

DISCUSSION: Like the Point Barrow shells, these specimens vary from those that are longer than high to those that are higher than long, and have a periostracum ranging from a yellowish light brown to an olive brown, and in others the shells are so eroded that the periostracum is lacking. In some the broad ribs are clearly visible to the ventral margin, in others the shell is so coarse and eroded that little ribbing is discernible except in the region of the umbos. Internal crenations are visible even in the most misshapen shells.

In young specimens the length exceeds the height (pl. 22, fig. 9), but in adults the height usually exceeds the length (pl. 22, fig. 7). In those adults in which the length exceeds the height, the height has often been foreshortened by growing in a rugged environment that prevents the shell assuming a normal shape and the ventral margin grows inward instead of ventrad. One specimen from 130 feet (Aug. 9, 1949) with a shell 23.3 by 25.6 by 15.4 mm. has the ventral and anteroventral (the latter somewhat subtended) margins turned in to such an extent that the breadth at the ventral margin is as great as anywhere throughout the extent of the shell, making the shell boxlike (see pl. 22, fig. 10).

Cardita paucicostata is the young of *C. crassidens* or a *C. crassidens* that has been favored by fate. When the latter species does not grow in cramped quarters and does not become eroded and covered with other animals, it shows the same color and texture of periostracum attributed to *C. paucicostata*, and the length tends to remain equal to the height.

A shell from Point Barrow that is 24 mm. long by 22 mm. high is about 4 years old, and another 24 mm. long by 20 mm. high is about 5 years old.

DISTRIBUTION: Point Barrow to Puget Sound. Point Barrow is a new locality.

Family THYASIRIDAE

Genus *Thyasira* Lamarck, 1818

Thyasira flexuosa (Montagu, 1803)

Var. *sarsi* Philippi

PLATE 4, FIGURE 12

Tellina flexuosa Montagu, 1803, p. 72.
Lucina flexuosa Gould, 1841, p. 71, fig. 52.—*flexuosa* Philippi, 1845a, p. 74.
Lucina gouldii Philippi, 1845a, p. 75, pl. 2, fig. 7.
Axinus sarsii Philippi, 1845b, p. 91.—G. Sars, 1878, p. 60, pl. 19, figs. 6a–b.
Cryptodon gouldii Gould, 1870, p. 100, fig. 406.
Axinus flexuosus G. Sars, 1878, p. 59, pl. 19, figs. 4a–b.
Axinus gouldii G. Sars, 1878, p. 60, pl. 19, figs. 6a–b.
Thyasira gouldii Morris, 1952, p. 36, pl. 8, fig. 15.

A single living specimen 6.2 mm. long by 6.2 mm. high was dredged through the ice on Feb. 18, 1950, at a depth of 162 feet.

OTHER MATERIAL EXAMINED: Numerous specimens of var. *gouldi* from Norway, Spitzbergen, Iceland, Greenland, Nova Scotia, and Massachusetts; over 50 specimens of var. *gouldi* from localities ranging from Bering Strait to Juan de Fuca Strait and off Point Loma, Calif.

DISCUSSION: Madsen (1949) states that it is common practice to regard *T. gouldi* and *T. sarsi* as forms of *T. flexuosa* and Soot-Ryen (1932) treats them as such. Typical *T. flexuosa* and forma *gouldi* are higher in proportion to the length than forma *sarsi*. Both *T. flexuosa* and forma *gouldi* are somewhat truncate on the anteroventral border, whereas forma *sarsi* is evenly rounded (pl. 4, fig. 12). However, in a lot of about 30 specimens (Stanford collection) from Maine labeled *T. gouldi*, there are a few specimens that are evenly rounded anteroventrally. Madsen (1949) further states that the "form common in Iceland is the American *gouldi*," but that a few large specimens have the *sarsi* form.

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The specimen from Point Barrow is definitely the *sarsi* and not the *gouldi* form, being as long as high and evenly rounded on the anteroventral border.

DISTRIBUTION: *T. flexuosa*, including the forms *sarsi* and *gouldi*, occurs from Point Barrow south to San Diego, Calif.; in the western Atlantic it occurs as far south as Connecticut; it is widely distributed in the eastern Arctic, extending along the coast of Europe and into the Mediterranean. The form *gouldi* has been reported from Bering Strait to San Diego and from Greenland to Connecticut; Iceland and Europe. Forma *gouldi* occurs on both our east and west coasts, and forma *sarsi* occurs at Point Barrow.

Genus *Axinopsida* Keen and Chavan, 1951

Axinopsida orbiculata (G. O. Sars, 1878)

PLATE 20, FIGURE 2

Axinopsis orbiculata G. Sars, 1878, p. 63, pl. 19, figs. 11a–d.—Soot-Ryen, 1939, p. 14, pl. 1, fig. 7.

A single specimen, measuring 3.2 mm. long by 3.4 mm. high, was dredged at 120 feet on Aug. 8, 1949.

OTHER MATERIAL EXAMINED: About 34 specimens from localities ranging from Cumberland Gulf to off Cape Cod, Mass.; also over 20 specimens of the var. *inaequalis* Verrill and Bush from Nova Scotia, Maine, and near Cape Cod.

DISCUSSION: This species is higher in proportion to its length than *A. viridis* Dall, which some authors have suggested may be synonymous with *A. orbiculata*. In the latter the concavity in front of the beaks is greater and the posterodosal margin slopes more rapidly than in *A. viridis*. The ventral margin of *A. viridis* comes to more of a point than in *A. orbiculata*. However, these differences are not marked and further study may show that *A. viridis* is only a variety of *A. orbiculata*.

DISTRIBUTION: Madsen (1949) says that *A. orbiculata* is widely distributed in the Arctic; on the east coast of America south to Cape Cod; off Norway to just south of Lofoten, and north of the Hebrides. *A. orbiculata* is new to Alaska and the Pacific area of the Arctic.

Family UNGULINIDAE

Genus *Diplodonta* Bronn, 1831

Diplodonta aleutica Dall, 1901

Diplodonta aleutica Dall, 1901, p. 820, pl. 42, fig. 3.

A single specimen of what is probably the very young of this species was taken at 741 feet on Aug. 17, 1949; it measures 2.5 mm. long by 2.3 mm. high.

DISTRIBUTION: Point Barrow, Cape Lisburne, Aleutian Islands, and Sitka Bay, Alaska. Point Barrow is a new locality and represents an extension of range of over 2 degrees of latitude.

Family LEPTONIDAE

Genus *Pseudopythina* Fischer, 1878

Pseudopythina compressa Dall, 1899

PLATE 19, FIGURES 2, 3, 5

Pseudopythina compressa Dall, 1899, p. 888, pl. 87, figs. 1, 8.—Oldroyd, 1924, p. 136.

A specimen measuring 11.6 mm. long by 8.5 mm. high and 3.3 mm. in breadth washed ashore on Aug. 27, 1949, and a right valve 6.8 by 4.9 mm. washed ashore on Oct. 16, 1949.

OTHER MATERIAL EXAMINED: The type (from 23 fathoms from southwest of Hagemeister Island) and 18 shells and 5 valves from 17 stations, including Cape Lisburne (3 dead shells), Norton Sound (1 dead shell), Nunivak Island, the Aleutians, the Shumagins, Kodiak Island, Sitka Harbor, British Columbia, La Jolla, California, and off Acapulco, Mexico. With the exception of about 4 specimens, all of these were dead and sometimes beach-worn shells.

DISCUSSION: Oldroyd's (1924) figure 11 of plate 11 is of *P. rugifera* and not of *P. compressa* as labeled. This error, coupled with the fact that Dall, in his description of *P. compressa*, failed to call attention to the spinules on the dorsal margin of the right valve, has resulted in some workers trying to separate, on the basis of minute differences, specimens of *P. rugifera* into *P. rugifera* and *P. compressa*, when, in actuality, the two species are quite distinct. One of the specimens figured here (pl. 19, fig. 2) has 4 spinules on the dorsal margin posterior to the beaks and one anterior to the beaks. The number of these spinules is greater in large specimens than in small specimens.

DISTRIBUTION: Point Barrow south through Bering Sea and east and south to British Columbia; off the Columbia River, Oregon, off southern California, and off Baja California, Mexico. Point Barrow is a new locality.

Genus *Mysella* Angas, 1877

Mysella sovaliki, new species

PLATE 4, FIGURE 10

Shell minute, white, subelliptical, tumid, sturdy for its size, covered with a pale tan periostracum; posterior margin rather abrupt, anterior gently sloping, ventral margin convex, anteroventral margin somewhat produced, evenly rounded. Beaks very low, located about two-thirds the distance back from the anterior end. Sculpture of

fine concentric incremental lines, with about 6 growth-cessation lines. Teeth (as for the genus: 2 in right valve, none in left) large for size of shell, subequal. Muscle scars rounded, pallial line even.

DIMENSIONS: Holotype, length 2.3 mm.; height, 1.9 mm.; depth, 1.4 mm.

TYPE LOCALITY: About 12.1 miles off Point Barrow base, Alaska. Depth, 741 feet. Bottom, mud (haul containing mostly terebellid worm tubes, chiefly *Pista maculata*). Collected by G. E. MacGinitie, Aug. 17, 1949.

REPOSITORY: Holotype in U. S. National Museum, No. 610302.

OTHER LOCALITIES: Three specimens (labeled *Montacuta dawsoni*; USNM 170490) from Greenland.

REMARKS: The resilium of this specimen is missing. This species belongs near *M. tumida*. It is more tumid and more trigonal than the latter, and the posterior tooth is not so elongate as that of *M. tumida*. It is named in honor of Mr. Pete Sovalik, an Eskimo assistant at the Arctic Research Laboratory.

Genus *Montacuta* Turton, 1822

Montacuta planata (Dall, 1885)

PLATE 20, FIGURES 1, 3–7, 9–11

Unnamed bivalve No. 7, Möller, 1842a, p. 24.
Montacuta elvata Mörch, *in* Jones, 1875, p. 131 (not of Stimpson, 1851).
Montacuta molleri "Holboll" Mörch, *in* Jones, 1875, p. 131; *in* Rink, 1877, p. 441 (name only).
Montacuta ferruginosa var. *gronlandica* Mörch, *in* Rink, 1857, p. 91 [specimen No. 164] (fide Posselt, 1898, p. 75).
Tellimya planata Dall, *in* Krause, 1885a, vol. 51, p. 34, pl. 3, figs. 6a–d.
Montacuta molleri Posselt, 1898, vol. 23, p. 74.
Mysella planata Dall, 1899, p. 892, pl. 88, fig. 12.
Mysella molleri Dall, 1899, p. 891, pl. 88, fig. 14.
Rochefortia planata Dall, 1921, p. 37.—Oldroyd, 1924, p. 132.

Eight fairly typical living specimens were dredged: 1 (1.9 mm. long by 1.4 mm. high) from 216 feet; 1 (4.4 by 3.3 mm.) from 328 feet; 1 (2.8 by 2.1 mm.) from 341 feet; 1 (3.3 by 2.4 mm.) from 477 feet; and 4 (1.5 by 1.1 mm., 1.8 by 1.4 mm., 2.2 by 1.6 mm., and 2.8 by 2 mm.) from 741 feet.

Four other living specimens, possibly variants of *M. planata*, were dredged: 3 (6.9 by 4.9, 3.1 by 2.4, and 1.5 by 1.3 mm.) from 477 feet and 1 (1.8 by 1.4 mm.) from 741 feet.

OTHER MATERIAL EXAMINED: The type (1 right valve) and cotypes (USNM 159303) of Dall's *Tellimya planata* from Plover Bay, Siberia (see pl. 20, fig. 3); his figured type (USNM 159310) from the Shumagins (pl. 20, fig. 6); and approximately 30 specimens (including dead shells) from localities ranging from Icy Cape (1 specimen), Nunivak

Island, the Aleutians, and the Shumagins. Dall's type lot (USNM 333648) of *Mysella molleri* from Greenland (see pl. 20, fig. 5). Six specimens from Frederikshaab, western Greenland, sent to me by Dr. Thorson (see pl. 20, fig. 1).

Discussion: The shells have a thick, light brown periostracum. All of them are eroded at the umbos (pl. 20, fig. 9). In the largest shell from Point Barrow (from 328 feet) the erosion extends to the ventral one-fourth of the shell, and at the umbos the erosion is so deep that the tooth is visible from the exterior. This shell is larger and more inflated than the others and the teeth are particularly large and coarse. This specimen contained 24 embryos, with shells about 0.65 mm. in length (see pl. 20, fig. 4).

In the 4 atypical specimens mentioned above, the umbos (which are eroded as in typical *M. planata*) are somewhat more centrally located than in typical specimens, the shell appears thinner, and the periostracum seems to be somewhat more wrinkled. In the largest specimen (pl. 20, fig. 7), the only one opened, the hinge teeth are exceptionally small, being about half as large as those of a typical *M. planata* of comparable size, a character that is compatible with the thinner and less chalky nature of the shell.

In the synonymy above, the first four references and the sixth are taken from Dall (1899, p. 891). He states "Posselt furnishes the link which connects the name with Mörch's unnamed diagnosis. The identification can take date only from 1898 as all the previous references were absolutely without any means of identification." I have not had access to all of the literature cited in these references but if Dall's statement is correct, *Montacuta molleri* Mörch must fall as a synonym of *Montacuta planata* (Dall), for in 1885 Dall described this species as *Tellimya planata* from some shells from Plover Bay (pl. 20, fig. 3). Although Posselt gave validity to *Montacuta molleri* by his description in 1898, Dall's description of *Tellimya planata* was earlier.

Dall's original description of *Tellimya planata* (1885a) was accompanied by a poor outline drawing, apparently by Krause, for Dall later apologized for the illustration and pictured a specimen he had selected for the figured type of *Mysella planata* (Dall) (1899, pl. 88, fig. 12). The shell he selected is a thin-shelled, small-toothed form in which the umbos are not quite so close to the posterior end (pl. 20, fig. 6) as in his type of *M. planata*; it resembles the largest of the shells mentioned above from 477 feet from Point Barrow (pl. 20, fig. 7). In the same paper Dall assigned some shells from Greenland (pl. 20, fig. 5) to *Mysella molleri* (Mörch) and selected for the figured type a typical *Montacuta planata*.[13]

[13] Dall's *Rochefortia beringensis* and *R. grebnitzski* belong to the genus *Montacuta*. The southern range given for *Mysella tumida* Dall is incorrect—the specimens from off Santa Rosa Island and Monterey Bay belong to two other genera; hence the southern limit for *M. tumida* is Puget Sound.

DISTRIBUTION: Eastern Siberia and Point Barrow, Alaska, to the Shumagin Islands; Greenland, Spitzbergen, and Novaya Zemlya. Point Barrow is a new locality.

Suborder CYCLODONTA

Family CARDIIDAE

Genus *Clinocardium* Keen, 1936

Clinocardium ciliatum (Fabricius, 1780)

PLATE 26, FIGURE 4

Cardium ciliatum Fabricius, 1780, p. 410.—G. Sars, 1878, p. 46, pl. 5, figs. 4a–b.—Oldroyd, 1924, p. 142, pl. 19, figs. 8, 8a.
Clinocardium ciliatum Morris, 1947, p. 41, pl. 17, fig. 3; 1951, p. 63, pl. 17, fig. 3; 1952, p. 39, pl. 9, fig. 9.—Kira, 1954, p. 111, pl. 55, fig. 2.

Four living specimens ranging from 45 mm. long by 43 mm. high to 62 by 60 mm. were taken from 110 feet (Sept. 8, 1948), 152 feet, 453, and 522 feet. A shell 21 by 20 mm. was taken at Eluitkak Pass (Aug. 10, 1948), another 25.5 by 24.5 mm. at 110 feet, and 1 valve 28 by 27 mm. at 295 feet.

OTHER MATERIAL EXAMINED: Many specimens from localities ranging from Icy Cape (1 valve), Cape Prince of Wales (1 valve), and Bering Strait to the Pribilofs, the Aleutians, and Sitka Harbor; also from Davis Strait, Greenland; Labrador, Newfoundland, Maine, and Massachusetts; and from Iceland.

DISTRIBUTION: From Point Barrow to Puget Sound and Japan; in the Atlantic area from the Arctic Ocean to Cape Cod and northern Norway. This is the first record of living specimens from north of Bering Strait.

Genus *Serripes* Gould, 1841

Serripes grönlandicus (Bruguière, 1789)

PLATE 26, FIGURE 5

Cardium grönlandicum Bruguière, 1789, p. 222.
Serripes grönlandicus Gould, 1870, p. 145, fig. 454.
Serripes groenlandicus Clench and Smith, 1944, p. 28, pl. 13, figs. 5–7.—Abbott, 1954, p. 401, pl. 32d.

A total of 31 living specimens and 7 shells was collected from 19 stations (never more than 3 at any one station) and 3 living and 3 dead specimens were washed ashore in August and September 1949. Three of the living specimens and 3 shells came from Eluitkak Pass, 1 from 328 feet, and 1 from 420 feet, the remainder coming from depths of 50 to 184 feet. The majority of these specimens are over 20 mm. in length; the largest (from 328 feet) is 60 by 51 by 28 mm.

Young specimens were taken as follows: 1 (slightly over 3 mm. long) at 152 feet on Oct. 14, 1949; 1 (9 mm.) at 138 feet on Aug. 1, 1950; 1 (9 mm.) at 151 feet on Aug. 5, 1950; 2 (5.5 mm. and 11 mm.) at 175 feet on Oct. 14, 1949; 1 (15 mm.) at 184 feet on Aug. 30, 1949; 3 (13, 16.5, and 19 mm.) at 125 feet on Sept. 9, 1948; and 1 (19 mm.) at 120 feet on Aug. 8, 1949.

Other material examined: Numerous specimens from localities ranging from the mouth of the Mackenzie River to Point Barrow and south and east to the southern coast of Washington; several from the Atlantic area.

Discussion: The shells of this species, at least those from Point Barrow, are very brittle and often crack while in the trays, pieces even breaking off entirely. They vary in color from a rosy gray to an olive tan, even on the same shell; some show zigzag markings of rose, others are nearly a solid color—grayish tan, for instance. The lines of annual growth are usually darker in color than the remainder of the shell (pl. 26, fig. 5). The siphons, foot, and mantle edge are reddish brown on a cream background.

Three shells from Point Barrow, measuring 47, 53, and 54 mm., show growth ridges indicating that they are at least 6 years old. What may be called secondary growth ridges, indicating a temporary cessation of growth, are about as prominent as the yearly growth lines, making the determination of age difficult. One shell 54 mm. in length appears to be 9 or 10 years old, but may be only five.

Distribution: Throughout the Arctic; from the Pacific area south to Puget Sound, and Hakodate, Japan; from the Atlantic area south to Cape Cod; and from Finmarken and Iceland.

Suborder Teleodonta

Family Tapetidae

Genus *Liocyma* Dall, 1870

Liocyma fluctuosa (Gould, 1841)

Plate 23, figures 1–8

Venus fluctuosa Gould, 1841, p. 87, fig. 50.
Tapes fluctuosa Gould, 1870, p. 136, fig. 447.
Liocyma beckii Dall, 1870b, p. 257; 1871, p. 145, pl. 14, fig. 7.
Liocyma scammoni Dall, 1871, p. 145, pl. 14, fig. 9.
Liocyma viridis Dall, 1871, p. 146, pl. 14, fig. 8.—Oldroyd, 1924, p. 159, pl. 1, fig. 3.
Liocyma aniwana Dall, 1907, p. 172; 1925, p. 18, pl. 28, figs. 4, 6; pl. 29, figs. 1, 2.
Liocyma schefferi Bartsch and Rehder, 1939, p. 111, pl. 8, figs. 1, 1 b.
Liocyma fluctuosa Morris, 1951, p. 71, pl. 43, fig. 2.

A total of 42 specimens, including 3 or 4 drilled shells, was collected. Six were washed ashore: 1 (12.2 mm. long) on Sept. 12 and

5 (from 8.5 to 13 mm.) on Sept. 22, 1949. Three were taken in a plankton net when it touched bottom: 1 (4 mm.) on Nov. 1, 1949, and 2 (2.5 and 3.8 mm.) on July 13, 1950. Eleven (from 3.1 to 5.5 mm. long) were dredged at a depth of 10 feet on Oct. 11, 1949; 1 (17.4 mm.) at 72 feet; 2 (18.9 and 24.6 mm.) at 80 feet on Aug. 21, 1948; 1 (9.5 mm.) at 132 feet; 1 (20.3 mm.) at 175 feet; 6 (from 16 to 27 mm.) at 246 feet; 2 (17.6 and 20.6 mm.) at 295 feet; 3 (5.6, 15.1, and 15.2 mm.) at 341 feet; 3 (2.5, 12.2, and 15.3 mm.) at 453 feet; 1 (19 mm.) at 522 feet; and 2 (11 and 13.7 mm.) at 741 feet.

In all of the Point Barrow specimens the umbos are eroded—even the very smallest ones are somewhat eroded. Two of the specimens that washed ashore on September 22 contained very large eggs and another contained eggs in earlier stages of development.

Other material examined.—The types of *L. viridis*, *L. becki*, *L. aniwana*, *L. scammoni*, and *L. schefferi* (there is only one specimen of *L. schefferi*) and all other specimens of these species as well as all of the specimens of *L. fluctuosa* in the U. S. National Museum.

Discussion: After examining these specimens and taking many measurements, I am of the opinion that the above species are but variants of *L. fluctuosa*. Arctic shells are highly variable, and the variations exhibited by these "species" are no greater than, perhaps not so great as, those found in *Astarte borealis* and *A. montagui*, for instance. Young specimens of *Liocyma fluctuosa* tend to be more trigonal than larger specimens. Specimens of *L. viridis* are no more produced and arched along the ventral margin than many specimens of *L. fluctuosa;* in some specimens of *L. viridis* the sinus is rounded and in others it may be sharply angulated, and these same variations may be found in the sinus of *L. fluctuosa;* muscular scars are no smaller than those in comparable specimens of *L. fluctuosa*. *L. schefferi* is a tumid specimen in which the concentric sculpture is faint except at rather evenly spaced intervals, where flattened waves occur. Similar sculpture may be found in specimens of *L. viridis*, *L. becki*, and *L. fluctuosa* (pl. 23, fig. 8). Still other specimens of these last three forms may have closely spaced concentric undulations in various combinations with the widely spaced type. Young specimens of *L. aniwana* have practically the same proportions as young *L. fluctuosa*, but the specimen that was selected as the type is especially thin and shallow.

With the exception of those of *L. becki*, the percentages given in table 5 fall within the normal limits of variation. It is possible that the specimen selected was an extreme variant rather than typical.

TABLE 5.—*Ratios of measurements in several "species" of* Liocyma

"Species"	Length (in mm.)	Height: Length	Breadth: Height	Breadth: Length
fluctuosa (from Gulf of St. Lawrence)				
tumid specimen	Under 15	80.1%	60.7%	48.6%
tumid specimen	Under 15	81.3	58.9	47.5
tumid specimen	Under 15	83.0	53.0	44.0
scammoni (from British Columbia)				
type	Over 20	80.3	61.4	49.2
cotype	Over 20	78.9	62.3	49.2
specimen	Over 15	82.1	57.8	46.3
specimen	Over 15	75.9	58.8	44.6
schefferi (from Chuginadak Island)				
type	Under 15	80.8	56.0	45.2
aniwana (from Sakhalin)				
type	Over 20	72.9	53.9	39.8
specimen	Over 15	78.3	56.7	44.1
specimen	Under 15	80.2	63.9	52.3
viridis (from "Arctic Ocean")				
type	Over 20	67.4	54.4	36.3
specimen	Over 20	76.3	49.7	37.9
specimen	Under 15	76.6	49.5	40.0
specimen	Under 15	77.7	50.0	38.8
becki (from Plover Bay)				
type	Under 15	96.4	73.7	71.1
sp. (from Point Barrow)				
specimen	Over 20	74.4	63.4	47.2
specimen	Over 20	75.0	62.1	47.2
specimen	Over 20	77.4	60.7	47.0
specimen	Over 20	79.2	63.3	50.2
specimen	Over 15	77.4	53.4	47.3
specimen	Under 15	78.0	46.6	36.4
specimen	Under 15	80.1	47.9	39.2

Also, in a number of species, specimens from Plover Bay have characteristics developed to a degree not shown by specimens of the same species from other localities. Most specimens of *L. becki* do not show such great height in proportion to the length.

One lot of 7 specimens of *Liocyma* (from Point Barrow) of various sizes and with concentric sculpture varying from closely set to widely spaced, including two with a combination of the two types of sculpture, were sent to the museum in Copenhagen for comparison with the European *Liocyma*. W. K. Ockelmann identified all the specimens as *L. fluctuosa*.

In view of the above findings, it is obvious that a thorough study of the genus is indicated to determine if these various forms can actually be separated into species or if they are merely variants of one species.

DISTRIBUTION: The Arctic Ocean southward to northern Japan and eastward to Kodiak Island and Port Etches (long. 147° W.), Alaska; in the Atlantic area southward to Nova Scotia and Massachusetts ?; the White Sea, and Iceland. *L. fluctuosa* is a new name in the Pacific-Arctic fauna.

Family TELLINIDAE

Genus *Tellina* Lamarck, 1799

Tellina lutea Wood, 1828 (*ex* Gray, MS.)

Tellina lutea Wood, 1828, pl. 1, *Tellina*, fig. 3.—Dall, 1900, p. 322, pl. 4, figs. 15, 16.—Oldroyd, 1924, p. 169, pl. 1, fig. 9.—Abbott, 1954, p. 425, figs. 87c,d.
Tellina lutea venulosa Schrenck, 1861, p. 412.—Oldroyd, 1924, p. 169, pl. 1, fig. 11.
Peronidia venulosa Kira, 1954, p. 120, pl. 60, fig. 29.

Neither living nor dead specimens of this species were dredged in the area investigated off Point Barrow base, but about 200 yards inland from the shore, at depths of from 8 to 15 feet, where a tunnel was being excavated for the storage of food, shells and valves were abundant. Shells up to 74 mm. long were found.

OTHER MATERIAL EXAMINED: (Including *T. lutea venulosa.*) Numerous specimens from localities ranging from Bering Island, the Pribilofs, and the Aleutians to Cook Inlet; also Sakhalin Island, northern Japan.

DISCUSSION: In some of these specimens the posterior end is almost straight and in others it is as curved as that of *Macoma nasuta.* In some there are lamellose extensions at the lines of growth. There is great variation in the weight of shells of the same size. *T. lutea venulosa* is said to be "much narrower and more pointed at the posterior end," but examination of many specimens shows that there are all combinations of characters and all intergrades. The "venulose" characteristic is found only in specimens in which the periostracum has been injured, allowing chemical action and the deposition of foreign materials in checks in the shell.

DISTRIBUTION: Point Barrow, Alaska, the Aleutians and Cook Inlet, also northern Japan, and Bering Island east of Kamchatka.

Genus *Macoma* [14] Leach, 1819

Macoma incongrua (Martens, 1865)

Tellina incongrua Martens, 1865, p. 430.
Macoma incongrua Oldroyd, 1924, p. 170, pl. 42, fig. 10.

A single specimen, measuring 25 by 20 by 8.5 mm., washed ashore on Sept. 22, 1949.

OTHER MATERIAL EXAMINED: Several specimens from Alaska.

DISTRIBUTION: From Point Barrow south to San Diego, Calif., and also from Japan. Point Barrow is a new locality.

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[14] Since no specimens of *Macoma planiuscula* Grant and Gale were found at Point Barrow, the species does not come within the scope of this paper. However, while examining specimens of the genus *Macoma* in the U. S. National Museum, I observed some from England labeled *Macoma praetenuis* Woodward that appeared to be identical with *M. planiuscula.* Time did not permit a thorough investigation, but it is a matter that should be studied further.

Macoma calcarea (Gmelin, 1792)

PLATE 24, FIGURES 5–7; PLATE 26, FIGURES 6–9

Tellina calcarea Gmelin, 1792, vol. 7, p. 3236.
Macoma calcarea Oldroyd, 1924, p. 173, pl. 42, fig. 5.—Abbott, 1954, p. 430, fig. 88f (outline drawing).

This was one of the three most abundant species of bivalves collected in the area investigated at Point Barrow, and over 200 specimens were taken. It was found at all stations having a muddy bottom, including the stations at 477 feet (2 small, 8.5 mm. and 10.5 mm. long) and 741 feet (2 small, about 8 mm. and 11 mm.; 1 large, the next to the largest specimen taken, 41.3 by 27.5 by 12.3 mm.). A few small specimens were taken from bottoms characterized by rocks and stones: 1 (7.5 mm. long) from 295 feet; 1 (5 mm.) from 341 feet; and 1 (9 mm.) from 453 feet. The others came from stations with originally muddy bottoms or stations where mud had been deposited in the autumn of 1949. The majority of specimens range between 13.5 and 37 mm. in length; the largest (47.5 mm. long by 26 mm. high) came from 141 feet.

In addition to those mentioned above, small specimens were collected as follows: 3 (between 8.5 and 11 mm.) from 72 feet on July 21, 1950; 1 (about 6 mm.) from 120 feet; 1 (about 8 mm.) from 130 feet; 25 (between 8.5 and 17.5 mm.) from 132 feet; 2 (about 7 mm.) and 8 (between 13.5 and 17 mm.) from 148 feet; 1 (about 2.5 mm.) from 151 feet; 1 (about 5 mm.) from 162 feet; 1 (about 7 mm.) from 185 feet; 9 (between 8.5 and 20 mm.) from 204 feet; and 8 (between 9 and 21 mm.) from 213 feet. The haul from 132 feet also yielded 13 specimens from 19.5 to 39.5 mm. long and the one from 148 feet yielded 14 specimens from 14.5 to 37 mm. long.

At Point Barrow, *M. calcarea* lives in extremely sticky mud, making it necessary to wash each specimen separately. Dragging the loaded dredge in the wake of the boat was entirely ineffectual—the mud had to be worked over by hand.

OTHER MATERIAL EXAMINED: About 40 specimens from localities ranging from Point Barrow to Plover Bay, Kamchatka, Nunivak Island, the Aleutians, and off the coast of Washington (12 specimens), off the coast of Oregon (1 specimen), and Monterey Bay (1 specimen); about 75 specimens from Labrador, Nova Scotia, Newfoundland, and Massachusetts; and over 100 specimens from Spitzbergen, Norway, Scotland, Iceland, and Greenland.

DISCUSSION: These shells vary from light to relatively heavy; some are considerably higher in proportion to the length than others (pl. 24, figs. 5, 6); some are more pointed posteriorly and in some the posterodorsal margin slopes more abruptly than in others; some are more inflated below the hinge than others; and in some the laminate

edge of the anterodorsal margin is higher than in others. Young specimens (pl. 26, figs. 6, 7) usually are higher in proportion to the length than older specimens. Typically, the ventral line of the pallial sinus becomes confluent with the main pallial line about the middle of the length of the sinus (pl. 24, fig. 7); but in some shells only about two-fifths of the ventral line is confluent with the ventral line of the pallial sinus, and in others almost three-fifths of the line is confluent.

Yearly growth lines of the Point Barrow shells of this species are less distinct than in some of the other shells. One shell 18 mm. long is at least 2½ years old, 2 shells 30 mm. and 32 mm. long are at least 4½ years old, and 1 shell 39 mm. long is over 5 years old. Another shell only 28 mm. long and about 17.3 mm. high appears to be between 5 and 6 years old, making approximately the following growth in height each year: first, 4 mm.; second, 3.7 mm.; third, 3.5 mm.; fourth, 3 mm.; and fifth, 3.1 mm.

Although *M. balthica* Linnaeus has been reported from this vicinity, fairly intensive work in the area under investigation yielded no specimens. The writer believes that the young of *M. calcarea* have been mistaken for *M. balthica*. The greater height in proportion to the length in young *M. calcarea* could account for this misidentification.

DISTRIBUTION: Throughout the Arctic and southward to Japan and Monterey Bay in the Pacific and southward to New York and the British Isles and Denmark in the Atlantic.

Macoma moesta (Deshayes, 1854)

PLATE 21, FIGURES 1–3; PLATE 23, FIGURE 10; PLATE 24, FIGURES 1–3

Tellina moesta Deshayes, 1854, p. 361.
Macoma krausei Dall, 1900, p. 322, pl. 4, fig. 8.
Tellina (*Macoma*) *moesta* Jensen, 1905, p. 345, figs. 4a–c.
Macoma oneilli Dall, 1919c, p. 20, pl. 2, fig. 1; 1921, p. 47.—Oldroyd, 1924, p. 173, pl. 40, fig. 7.

Eight adult specimens were dredged: 1 (22.2 mm. long by 14.1 mm. high) at 80 feet on Aug. 21, 1948; 1 (24.4 by 16.7 mm.) at 120 feet on Aug. 9, 1949); 2 (23.8 by 15.6 mm., and 17.2 by 12.1 mm.) at 122 feet; 1 (24.3 by 16.4 mm.) at 132 feet; 1 (23.3 by 16.5 mm. at 134 feet; 1 (22.6 by 16 mm.) at 138 feet; and 1 (20.8 by 14.6 mm.) at 148 feet.

Seven smaller specimens and 1 valve that may be the young of this species were collected: 1 at 50 feet on July 26, 1948; 1 and 1 valve at 80 feet on Aug. 21, 1948; 4 that washed ashore on Sept. 12, 1949, and 1 on Sept. 19, 1949. These shells range between 10.6 and 16.6 mm. in length.

OTHER MATERIAL EXAMINED: Dall's cotype of *M. oneilli* from Dolphin and Union Straits, Northwest Territories; 3 from Winter Harbor,

Melville Island; 1 small specimen from Point Barrow; 1 from Icy Cape and 1 from between Icy Cape and Cape Lisburne; and 6 or 7 from Plover Bay. Also Dall's figured type and type lot of *M. krausei* from off Icy Cape, Alaska, 7–15 fathoms. Over 50 specimens labeled *M. moesta* from localities ranging from Icy Cape to Bering Strait to the Pribilofs, the Aleutians, and the Shumagins; also from Plover Bay and Kamchatka.

Discussion: Jensen (1905) places *M. krausei* Dall in the synonymy of *M. moesta*. Dall's type lot of *M. krausei* (pl. 21, figs. 1–3) consists of 4 small shells and 1 valve, ranging in length from 6.8 to 12.7 mm., and 1 dead shell (the figured type, pl. 21, fig. 1) 23.1 mm. in length. The small shells of *M. krausei* are very similar to the 7 small shells and 1 valve from Point Barrow, but the shell of the figured type (pl. 21, fig. 1) is more pointed and more extended posteriorly and less extended anteriorly, so that the umbos are not so near the posterior end as in the smaller shells and in the typical adults of *M. moesta*.

Although Dall described typical adult *M. moesta* as *M. oneilli*, the 50 or more smaller specimens mentioned above were identified as *M. moesta*. That Dall himself may have entertained some doubt as to the specific validity of *M. krausei* is suggested by the fact that he (Dall, 1921, p. 47) gives the following reference for *M. moesta* Deshayes: "Proc. U. S. Nat. Mus., vol. 23, pl. 4, fig. 8." This reference is for the original description of *M. krausei* and in this paper Dall (1921) does not even mention *M. krausei*.

The 7 small specimens (see pl. 24, figs. 2, 3) from Point Barrow correspond fully with the 50 smaller specimens labeled *M. moesta*. Some of the latter shells have a thin, transparent periostracum, others a yellowish olive-green; those from Point Barrow have the thin transparent periostracum. Those from Kyska Harbor and Amchitka Island are somewhat more inflated than usual; others from these two localities, as well as a few from the Shumagins, are somewhat higher in proportion to the length than others. Several small specimens of *M. moesta* from Greenland (sent to me by Dr. Thorson) have a yellowish olive-green periostracum and are high in proportion to the length (see table 6).

The 8 adult specimens from Point Barrow correspond fully with Dall's *M. oneilli* and they also correspond fully with Deshayes' description of *M. moesta*. W. K. Ockelmann of Copenhagen, who has compared them with specimens of *M. moesta* from Greenland, states that they are unquestionably *M. moesta*. Except on the anterior end, these shells have a brownish concretion along the margins (pl. 24, fig. 1), and the periostracum extends onto the interior surface for as much as 2 mm. (pl. 23, fig. 10).

TABLE 6.—*Proportionate lengths and heights of* Macoma moesta *and* M. "krausei"

(KEY: H, height at umbo; H′, height at highest point of shell; L, length. Measurements in millimeters, ratios in percent)

Species	*H*	*H′*	*L*	*H:L*	*H′:L*
M. moesta from Point Barrow					
specimen	10.2	10.3	15.3	66.6	67.3
specimen	15.6	16.8	23.8	65.5	70.6
M. moesta from Greenland					
specimen	8.2	8.4	11.4	71.9	73.7
specimen	11.9	12.0	16.8	70.2	71.8
specimen	12.7	13.0	18.1	70.8	71.4
M. "krausei"					
figured type from Icy Cape	14.0	14.5	23.1	60.6	62.7
small specimen from Point Barrow	7.8	7.9	12.7	61.3	62.2

The longer length of *M. krausei* to its height in comparison with that of *M. moesta* is demonstrated in table 6. However, it is highly probable that Dall's specimens of *M. krausei* are simply extreme variants and that the greater length of these specimens comes within the normal limits of variation of *M. moesta*.

DISTRIBUTION: Point Barrow, Alaska, Nunivak Island, the Aleutians, coasts of Washington, Oregon, and Monterey Bay, Calif., also Kamchatka; W. K. Ockelmann (personal communication) gives the Atlantic range as eastern and western Greenland, Baffin Land, Spitzbergen, Novaya Zemlya, and the Kara Sea; and Jensen (1905) adds the Tschuktscher Peninsula and the Siberian-Arctic Sea.

Suborder ASTHENODONTA

Family MYACIDAE

Genus *Mya* Linnaeus, 1758

Mya truncata Linnaeus, 1758

And var. *uddevallensis* Forbes

PLATE 25, FIGURES 1–3

Mya truncata Linnaeus, 1758, ed. 10, p. 670.—Oldroyd, 1924, p. 197, pl. 10, fig. 4.—Foster, 1946, p. 30, pls. 17–19.—Morris, 1951, p. 89, pl. 22, fig. 8; 1952, p. 58, pl. 16, fig. 5.—Abbott, 1954, p. 455, pl. 32v.

Mya truncata var. *uddevallensis* Forbes, 1846, p. 407.—Grant and Gale, 1931, p. 415.

Mya truncata var. *abbreviata* Jeffreys, 1865b, p. 67.

Approximately 25 specimens were collected: 12 specimens, usually with the animal intact and sometimes still living, and 4 valves washed ashore between Aug. 21 and Sept. 28, 1949; 2 specimens (55 and 55.3 mm.) and 1 valve (57 mm.) were taken at Eluitkak Pass; 1 juvenile (probably of true *M. truncata*) was collected at 10 feet on Oct. 14, 1949; 4 (from 6 to 8.5 mm.) came from 477 feet; 1 (19.5 mm.) came

from 217 feet; and 4 others (from 6 to 10.5 mm.) came from 122, 132, 184, and 341 feet. Eight of the specimens that washed ashore range between 39 and 55 mm. in length; 1 is 11 mm., and 2 are 18.5 mm.

One empty shell (about 57.5 by 43.7 by 29 mm.) and 1 valve of about the same size, taken from Eluitkak Pass on Aug. 10, 1948, belong to the var. *uddevallensis*.

Other material examined: Approximately 30 specimens from Norway, the Shetlands, Greenland, Cumberland Gulf, and Maine—about 4 of which belong to the var. *uddevallensis;* also specimens from Puget Sound.

Discussion: In typical *M. truncata* the posterior end (measured from the vertical from the beaks) is nearly as long as the anterior end, and the posterior end is obliquely truncate in such a manner that the ventral margin extends farther posteriorly than the dorsal (pl. 25, fig. 1). In typical var. *uddevallensis* the posterior end is so shortened that it is not much more than one-half as long as the anterior, and it is truncate in such a manner that the posterior dorsal margin is almost twice as long as the posterior ventral margin (pl. 25, fig. 3). Typical var. *uddevallensis* is much higher in proportion to the length than typical *M. truncata*, and the pallial sinus is much shorter in the former. However, there are all types of intergradations between these two extremes: In some specimens the posterior end is squarely truncate and in others even somewhat rounding-truncate; there are all degrees of relationship between the proportions of the length of the anterior and posterior ends; and the pallial sinus varies from extremely shallow to so deep that it may project anteriorly to or beyond a vertical line from the beaks. The shorter, *uddevallensis*, form tends to be more inflated in the anterior regions than the longer *M. truncata*.

The var. *uddevallensis* is sometimes listed as a separate species, and although typical var. *uddevallensis* differs markedly from typical *M. truncata*, complete series of intergradations leave no doubt that the former is only a variety of the latter. Foster (1946) considers *uddevallensis* merely an extreme variant of *M. truncata*. The *M. truncata* from Point Barrow (pl. 25, fig. 2) is intermediate between typical *M. truncata* and typical var. *uddevallensis*.

There has been considerable discussion regarding the differences between *M. truncata* and *M. arenaria*, some workers even going so far as to suggest that *M. truncata* is merely a variety of *M. arenaria*, but no one who has seen the living animals would fail to distinguish between adults of these two species. In *M. truncata* a thick, tough, loose, and highly wrinkled sheath of periostracum extends onto the siphons (see Abbott, 1954, pl. 32v) and covers them to the tip; in *M. arenaria* this sheath is very thin and closely adherent and does not extend very far. The pallial sinus of *M. arenaria* is narrower

than that of *M. truncata* and always is sufficiently long that a vertical line from the beaks cuts across it, whereas in *M. truncata* the sinus may or may not extend to such a vertical line. The ventral scar of the pallial sinus of *M. arenaria* is above and separate from the main pallial scar (pl. 25, fig. 5), whereas in *M. truncata* these scars are either contiguous or confluent throughout most of the length of the sinus (pl. 25, figs. 1–3).

DISTRIBUTION: *M. truncata* extends from Point Barrow south and east to Puget Sound; on the east coast from Greenland to Massachusetts (Johnson, 1934); Norway, Iceland, the Shetlands, and England. The var. *uddevallensis* has been collected at Point Barrow (G. E. MacGinitie, 1955), at Afognak and Raspberry Islands (near Kodiak Island), and in Sweden (W. J. Eyerdam) (see Burch, 1945, No. 44, p. 25); in Norway and Iceland and southward to the Bay of Biscay (see Madsen, 1949, p. 77). Point Barrow is a new locality for var. *uddevallensis*.

Mya pseudoarenaria Schlesch, 1931

PLATE 19, FIGURE 7; PLATE 25, FIGURE 4

Mya intermedia Dall, 1898, p. 857 (in part).

Mya truncata forma *ovata* Jensen, 1901,[15] pp. 139, 144, figs. 3–5, 6a–c (not *M. ovata* Donovan, 1802).

Mya pseudoarenaria Schlesch, 1931, p. 136, pl. 13, figs, 10–12.—Soot-Ryen, 1951, p. 3.

About 16 specimens were collected: Between Aug. 21 and Sept. 24, 1949, 4 specimens (from 23 to 67 mm. long) washed ashore; on Aug. 23, 1950, 1 specimen (31 mm.) washed ashore; 3 specimens and 5 valves (from 43 to 66 mm.) were dredged at Eluitkak Pass on Aug. 6, 10, 1948; 3 specimens (about 11 mm.) were dredged at 10 feet on Oct. 11, 1949; 1 (about 12 mm.) at 120 feet on Sept. 15, 1948; 1 shell (16 mm.) at 120 feet on Aug. 8, 1949; and 2 shells (13 and 14 mm.) and 1 living specimen (14 mm.) at 162 feet on Feb. 18, 1950. Specimens that washed ashore were often still alive.

OTHER MATERIAL EXAMINED: Numerous specimens of *M. "intermedia"* from the Probilofs, the Aleutians, and Kamchatka; specimens of *M. truncata* forma *ovata* from Greenland; several specimens of *M. japonica* Jay from Japan and Puget Sound; also specimens of *M. arenaria* from the Atlantic and Pacific coasts.

DISCUSSION: It is now generally conceded that all recent records of living *M. arenaria* Linnaeus (1758, p. 670) in the Arctic are of some other species. Dall (1898), realizing that a *Mya* from Alaska belonged neither to *M. truncata* nor to *M. arenaria*, described it as a new species under the name *intermedia*—a name that was later found to be pre-

[15] The date for this form is usually given as 1900. The volume was for the year 1900, but it was published in 1901.

occupied. Jensen (1901) also recognized that the northern form of *Mya* commonly assigned to *M. arenaria* is not this species, and he gave to this northern European form the name of *M. truncata* forma *ovata*. Madsen (1949), who found no *M. arenaria* in an extensive collection from Iceland, also uses the name *ovata* as a form of *M. truncata*, but Foster (1946) and Soot-Ryen (1951) consider *M. truncata* forma *ovata* Jensen a synonym of *M. pseudoarenaria* Schlesch.

Schlesch (1931) considered this northern form sufficiently distinct to warrant a specific name, as it probably does. Although he does not mention *M. japonica* Jay (1856),[16] he does refer to *M. intermedia* Dall, stating that he considers the latter distinct from *M. pseudoarenaria*. He states (translated from German): "It is astonishing, however, that *M. intermedia* Dall, also with *M. arenaria*, extends to Monterey in California. It shows therein greater agreement with *M. arenaria* than with *M. truncata*, which only extends to Puget Sound. While *M. pseudoarenaria* goes heart in hand with *M. truncata*, *M. intermedia* obviously stands closer to *M. arenaria*, a phenomenon of convergence." Although *M. japonica* Jay (=Dall's *M. intermedia*) is undoubtedly closely related to *M. arenaria*, and *M. pseudoarenaria* is more closely related to *M. truncata*, Schlesch's idea of convergence as related to range was based on Dall's misidentification of several small shells from the vicinity of Monterey. The specimen from Monterey Bay (in the U. S. National Museum) is not even a *Mya;* the 3 small specimens (about one-quarter inch long) from San Francisco Bay are undoubtedly the young of M. *arenaria;* and the 2 specimens (also measuring about one-quarter inch) from 13 fathoms off Punta Año Nuevo, Calif., are almost certainly the young of *M. arenaria*. But a specimen (about one-half inch long) from the Gulf of Georgia, British Columbia, and another specimen (about 1¼ inches long) from Bellingham, Wash., appear to be the young of *M. pseudoarenaria*.

Dall's lectotype of *M. intermedia* is shown in plate 19, figure 6. Since the name *intermedia* is unavailable, the figured shell can undoubtedly be assigned to *M. japonica* Jay. Jay (1856, p. 292) states that *M. japonica* "is similar to *M. arenaria*, but differs in the pallial impressions, which are much more profound, the tooth more thickened, a deep notch on its posterior, and an elevation on the anterior side, and the whole shell more ponderous and incrassated." In the specimen figured by Jay (1856, pl. 1, fig. 10) the pallial sinus is not so deep and the anterior end is not so long and high as in Dall's lectotype, in which the sinus is unusually large. In many specimens of *M. japonica* the pallial sinus is no deeper than in most *M. arenaria* (cf. pl. 19, fig.

[16] The date for *Mya japonica* Jay is usually given as 1857, but M. C. Perry's account, containing Jay's report on the shells, was published in 1856. Two editions of Perry's narrative, a quarto and an octavo, were published, both in 1856.

8, and pl. 25, fig. 5). The differences in tooth characteristics seem to be more constant.

Another specimen that Dall placed under *M. intermedia* is shown in plate 19, figure 7. In shape it is similar to *M. arenaria* but the pallial sinus and hinge are more like those of *M. truncata*. This shell is no doubt a *Mya pseudoarenaria*, which apparently never attains the large size reached by *M. japonica*. Dr. Rehder, who kindly checked for me the specimens in the U. S. National Museum labeled *M. intermedia*, found that none of the large specimens has a pallial sinus like that shown (pl. 19, fig. 7). It becomes obvious that Dall placed two different species under *M. intermedia*.

Although I have not seen the type of *M. pseudoarenaria*, nor any specimens identified as belonging to this species, it is almost certain that the shells from Point Barrow belong to it. The fossil specimens pictured by Schlesch do not show the pallial sinus clearly but he considers his species synonymous with *M. truncata* forma *ovata* Jensen, and specimens of the latter from Greenland, lent me by Dr. Thorson, are similar to the Point Barrow specimens (see pl. 25, fig. 4) and to the shell shown in plate 19, figure 7. Schlesch's description states (translation): "The shell is oval with more or less rounded posterior end and shows external fine and radiating striae. Superficially it looks much like *M. arenaria* but the form of the hinge plate shows that it stands next to *M. truncata*."

Living specimens from Point Barrow show another similarity to *M. arenaria* in that the sheath that extends onto the siphons is more like that of *M. arenaria*, for it is not nearly so tough, wrinkled, and extensive as in *M. truncata*.

Schlesch (1931) and Jensen (1901) report valves only, but Odhner (1915) reports small living forma *ovata* from the Isfjorden in Spitzbergen. Soot-Ryen (1951) reports seeing small living *M. pseudoarenaria* from Spitzbergen, and in June 1927 and August 1930 he and his companions collected 4 living specimens (ranging in length from 22.5 to 52 mm.) off the coast of Norway between lat. 69°56′ N. and lat. 67°8′ N.

M. pseudoarenaria is probably more abundant than collecting records indicate. Equipment available at Point Barrow was incapable of penetrating the substratum deeply enough to collect the larger specimens of this species; the largest specimens (see collecting data above) were either washed ashore by storms or were dredged at Eluitkak Pass, where surging waters roll the rocks around and churn up the mud sufficiently to expose some of the deeper mud-dwellers.

Distribution: Point Barrow to Bellingham, Wash. (exact Pacific records cannot be given until collections are reexamined with a view to separating *M. japonica* and *M. pseudoarenaria*); Greenland, Iceland, Spitzbergen, coast of Norway.

Family Hiatellidae

Genus *Panomya* H. and A. Adams, 1858

Panomya arctica (Lamarck, 1818)

Plate 19, figure 1; Plate 25, figures 6, 8

Glycimeris arctica Lamarck, 1818, vol. 5, p. 458; 1835, vol. 6, p. 70.
Panopaea arctica Gould, 1841, p. 37, fig. 27; 1870, p. 51, fig. 378.
Panomya turgida Dall, 1916, p. 416; 1921, p. 54, pl. 2, fig. 1.
Panomya ampla Oldroyd, 1924, pl. 10, fig. 3.—Morris, 1952, p. 93, pl. 16, fig. 10.—Kira, 1954, p. 123, pl. 61, fig. 17.
Panope (*Panomya*) *ampla* Grant and Gale, 1931, p. 426, pl. 21, figs. 10a, b.
Panomya arctica Morris, 1951, p. 91, pl. 43, fig. 16.

Three left valves of this species, ranging from 73 to 78 mm. in length, were dredged at 522 feet.

Other material examined: The figured type of *P. arctica*, the figured type of *P. turgida;* specimens of *P. arctica* from Scotland, fossils from Sicily, several specimens from localities ranging from Gaspé Bay, Quebec, to Chesapeake Bay; and 3 specimens of *P. turgida* from Unimak Pass, Unalaska Island, and Port Levasheff.

Discussion: Typically, the anterior end of *P. arctica* (pl. 25, figs. 6, 8) is rounded (instead of being tapered as in *P. ampla*) and the posterior end is obliquely truncate in such a manner that the ventral margin extends farther posteriorly than does the dorsal margin (pl. 19, fig. 1; pl. 25, figs. 6, 8; also see Dall, 1921, pl. 2, fig. 1). The degree of the posterior extension is highly variable, ranging from slight (see Oldroyd, 1924, pl. 10, fig. 3) to marked. In one specimen from Unalaska and one from Port Levasheff the dorsal margin extends as far as the ventral, and in the latter shell the anterior end is somewhat tapered (as in Oldroyd, 1924, pl. 10, fig. 3); but in none of these specimens does the dorsal margin extend beyond the ventral as is the case in *P. ampla*. I could detect no difference between specimens of *P. arctica* and *P. turgida*. There are specimens of *P. arctica* from our east coast that are practically identical with specimens called *P. turgida* from our west coast.

Distribution: Point Barrow south and east to Unalaska and the Shumagins; in the Atlantic area from the Arctic Ocean to Chesapeake Bay, the British Isles, and north of Europe. The specimens from Point Barrow extend the range into the Pacific area of the Arctic.

Panomya ampla Dall, 1898

Plate 25, figure 7

Mya truncata Middendorff, 1851, pl. 25, fig. 13.
Panomya ampla Dall, 1898, p. 833; 1902, p. 560, pl. 40, figs. 3, 4.

One living specimen was taken at Eluitkak Pass on Aug. 1, 1950, and 1 right valve was dredged at 184 feet. The former shell is 68 mm. long and 44.5 mm. high and the latter is 54 by 40 mm.

Other material examined: The figured type from Kyska Harbor, and about 20 other specimens from Nunivak Island, Kodiak Island, Kyska Island, and Unalaska Island.

Discussion: The shells of this species are usually flat but they vary from flat to somewhat inflated. The younger specimens tend to be flatter in proportion than the larger ones. There is also variation in the thickness or heaviness of the shells.

The shell of *P. ampla* is tapered anteriorly and flared posteriorly, and the posterior margin is obliquely truncate in such a manner that the basal line recedes (pl. 25, fig. 7). Oldroyd's (1924) figure 3 of plate 10 is of *P. turgida* (=*P. arctica*) and not of *P. ampla* as stated. This error has been repeated in several subsequent publications; the figures in the following references should read *P. arctica* instead of *P. ampla:* Grant and Gale (1931, pl. 21, figs. 10a, 10b); Morris (1952, pl. 16, fig. 8); and Kira (1954, pl. 61, fig. 17).

Distribution: The range of *P. ampla* has been given as the Aleutian region (see localities above) to Puget Sound but the latter locality record has been questioned. In the collections of the U. S. National Museum I saw no specimen of *P. ampla* from Puget Sound. The present range, therefore, is from Point Barrow to Kodiak Island, Alaska. It is new to Point Barrow and to Arctic America.

Genus *Hiatella* Daudin, *in* Bosc, 1801

Hiatella arctica (Linnaeus, 1767)

Plate 26, figures 1–3

Saxicava arctica Linnaeus, 1767, ed. 12, p. 1113.—Oldroyd, 1924, p. 208, pl. 9, fig. 6; pl. 51, fig. 4.—Morris, 1947, p. 67, pl. 23, fig. 5; 1951, p. 91, pl. 23, fig. 5; 1952, p. 62, pl. 16, fig. 7.

This was the most abundant bivalve and, with the exception of barnacles, probably the most abundant and the most nearly ubiquitous animal in the area under investigation. Probably no haul except from the strictly muddy bottoms near shore was without representatives of *H. arctica*. Even near shore in the gravel zone, they were found anchored to bits of gravel or old shells. Two specimens (4.5 and 5.5 mm. long) from 184 feet were found growing on the bryozoan *Tricellaria erecta*, and 2 others (5 and 6 mm.) from 341 feet were growing on the bryozoan *Eucratea loricata*. They were found between barnacles, in old clam shells, and among old holdfasts. In addition to 3 or 4 barnacles, an old shell of *Astarte borealis* contained 21 living

H. arctica ranging between 7 and 13.5 mm. in length. Among dozens of specimens (from 3 to 22 mm.) from 477 feet, there were many on which foraminifers were growing and one on which a young *Musculus* was attached to the byssus.

Hauls from Eluitkak Pass on Aug. 6, 1948, from 100 feet on Aug. 21, 1948, and from 125 feet on Sept. 9, 1948, were unusually rich in *Hiatella*. A haul from 150 feet on Aug. 23, 1948, not only was very rich, especially in young specimens, but about half of the mass brought up by the dredge was made up of old dead shells of *Hiatella*. The largest shell (38 mm. long by 16.3 mm. high) came from Eluitkak Pass, and a group of large shells (up to 31 by 14 mm.) came from 10 feet in the gravel zone on Sept. 8, 1949.

Because of their significance as regards growth, selected collecting data are given below: at Eluitkak Pass (Aug. 6, 1948), specimens 2.5 mm. long and up; at 184 feet, specimens 2.5 to 18 mm.; at 120 feet (Sept. 15, 1948), 2.5 mm. and up; at 477 feet, 3 to 22 mm.; at 295 feet, up to 8 mm.; at 80 and 100 feet (Aug. 21, 1948), 4 mm. and up; at 150 feet (Aug. 23, 1948), 4 mm. and up; at 216 feet, 4 to 12 mm.; at 120 feet (Aug. 8, 1949), 4.5 to 14 mm.; at 217 feet, 4 to 9.5 mm.; at 110 feet (Sept. 16, 1949), 5 mm. and up; at 453 feet, 5 to 9 mm.; at 185 feet, 5 to 15.5 mm.; and at 175 feet, 6.5 to 19 mm.

Other material examined: Numerous specimens from the Arctic, and from the Atlantic and Pacific.

Discussion: Many of the shells from Point Barrow are well shaped (pl. 26, figs. 1–3) (also Oldroyd, 1924, pl. 9, fig. 6) and not distorted as *H. arctica* often is (Oldroyd, 1924, pl. 51, fig. 4). Young specimens have the characteristic two rows of spines near the anterodorsal margin of each valve, but few retain them very long, their former presence being indicated only by eroded spots along the ridges, and even the latter are sometimes almost obsolete.

A shell of *H. arctica* 30 mm. long from Point Barrow is at least 5 years old.

The age-old problem as to whether or not *H. arctica* and *H. rugosa* constitute one or two species has received additional argument in favor of two species: Jorgensen (1946) found an oval larval form and a triangular larval form of *Hiatella*, the former attributed to *H. rugosa*, the latter to *H. arctica*. Abbott (1954, p. 453), who lists *H. rugosa* (Gmelin) as a synonym of *H. striata* (Fleuriau), states that the eggs of *H. arctica* are red, while those of *H. striata* are pinkish cream.

Distribution: As now conceived, *Hiatella arctica* ranges in the Pacific area from the Arctic to Panama, and in the Atlantic from the Arctic to the West Indies.

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PLATES 1–27

Explanation of Plate 1

Fig. 1.—*Margarites costalis* var. *grandis* Mörch from 341 feet, showing flattened base and almost complete absence of basal lirae.

Figs. 2, 3.—Varieties of *Margarites costalis* (Gould) from 341 feet, showing flattened base: 2, with weak basal lirae, central ones very faint; 3, with strong basal lirae throughout.

Figs. 4–7.—Varieties of *Margarites costalis* (Gould): 4, from 453 feet, with somewhat rounded base and weak basal lirae; 5, forma *multilirata* ? Odhner from 341 feet, with strongly rounded base and very faint basal lirae; 6, from 341 feet, with somewhat rounded base and strong basal lirae; 7, shown with its operculum, from 741 feet, base strongly rounded, strong basal lirae, and a few faint intercalary threads between primary lirae of body whorl.

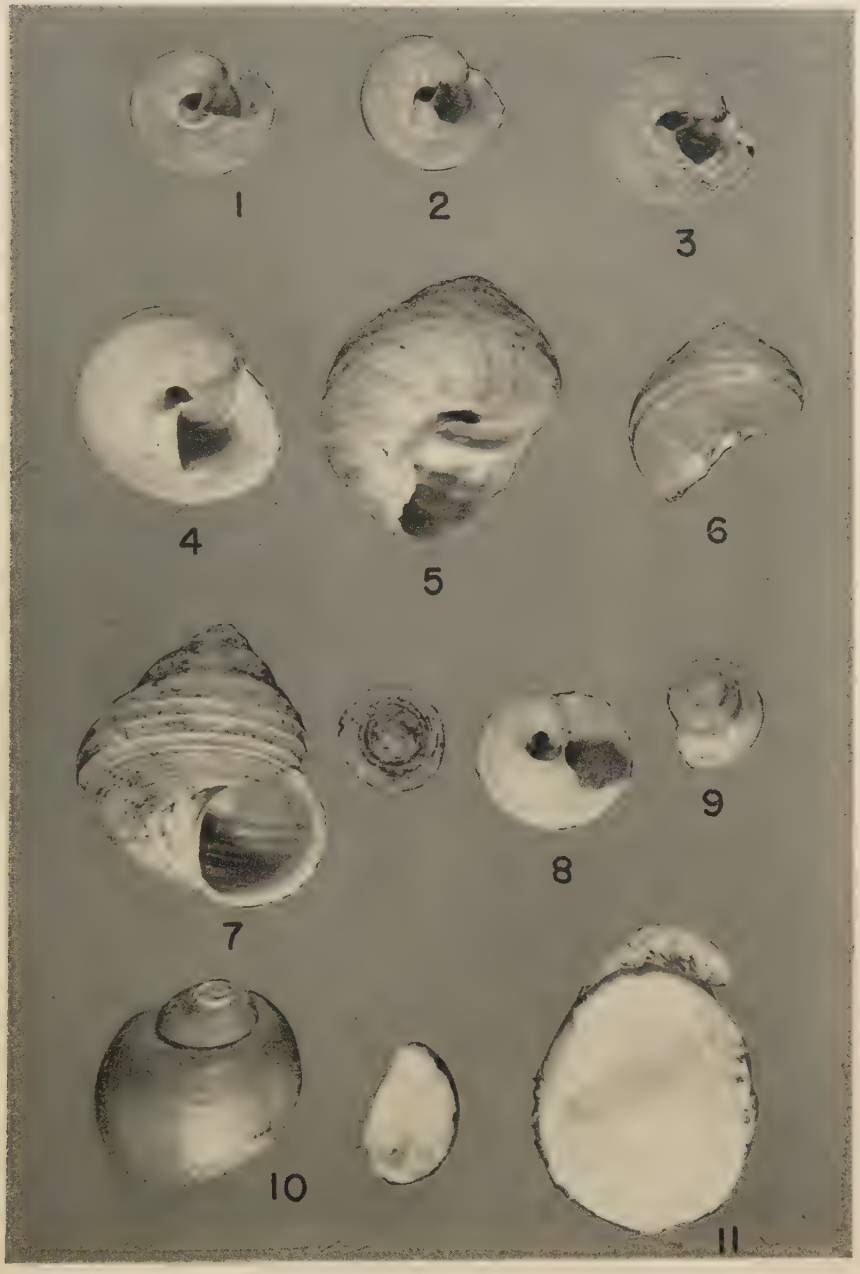
Fig. 8.—*Margarites avenosooki*, new species. Paratype (Stanford Univ. Paleo. Type Coll. No. 8331) from 420 feet, showing flared umbilical opening.

Fig. 9.—*Solariella obscura* (Couthouy) from 132 feet, apical view.

Fig. 10.—*Natica clausa* Broderip and Sowerby from 420 feet (shown with its operculum).

Fig. 11.—*Crepidula grandis* Middendorff from 130 feet (Sept. 15, 1948), showing strongly curved apex and heavy periostracum.

Magnification: All × 17.7.



Trochidae, Naticidae, and Crepidulidae. Explanation on facing page.

473771—59——11

Explanation of Plate 2

Fig. 1.—*Admete couthouyi* var. *middendorffiana* Dall from 80 feet, showing tumidity, weak axial folds, and broad canal.

Figs. 2, 3.—*Admete couthouyi* Jay, var., from 341 and 175 feet, respectively, showing more slender form, stronger axial folds and spiral sculpture, and narrower canal.

Fig. 4.—*Plicifusus kroyeri* (Möller) from 341 feet, young specimen.

Fig. 5.—*Puncturella noachina* (Linnaeus) from 184 feet, apical view.

Fig. 6.—*Margarites avenosooki*, new species, from 420 feet, showing weak axial folds, fairly uniform spiral lirae, and absence of keel. (Paratype, Stanford Univ. Paleo. Type Coll. No. 8331.)

Fig. 7.—*Margarites frigidus* Dall from 420 feet.

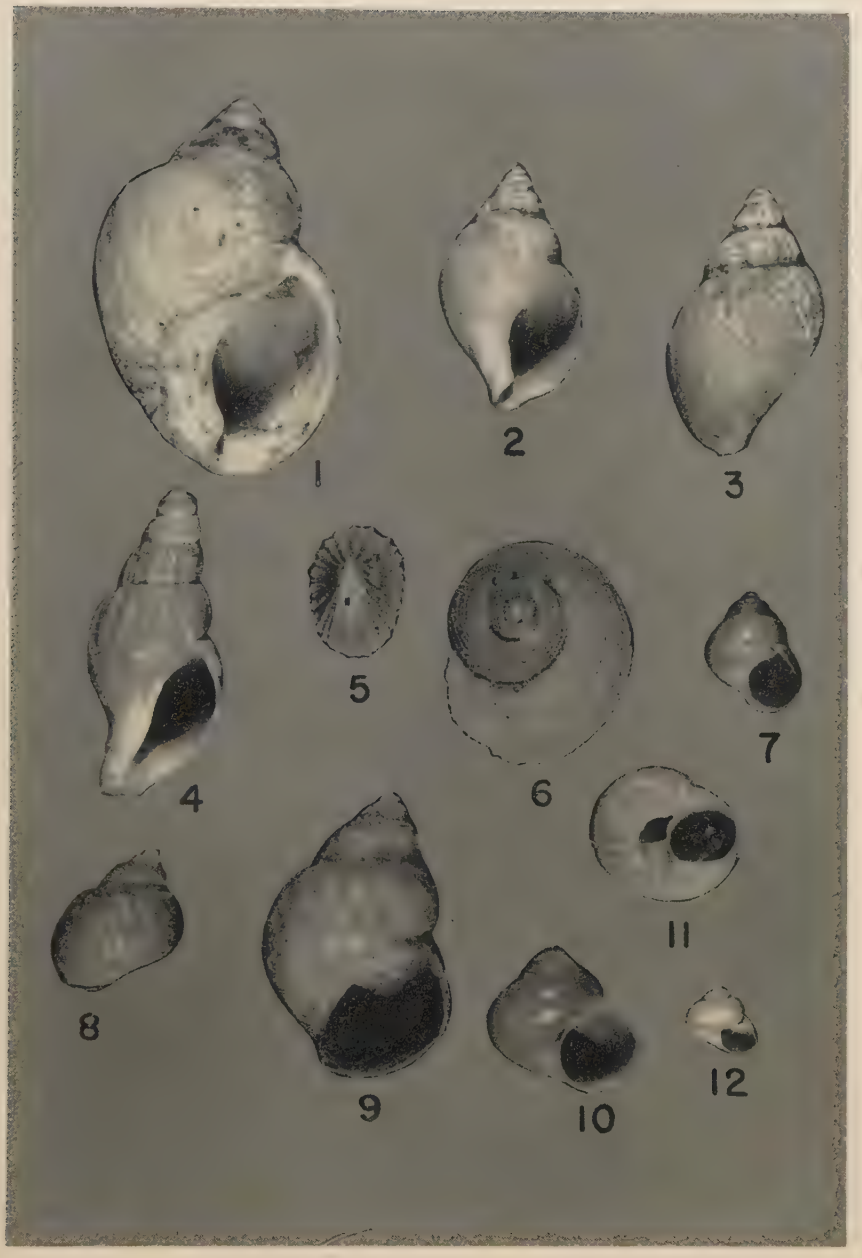
Figs. 8, 9.—*Aquilonaria turneri* Dall from 217 and 151 feet, respectively.

Fig. 10.—*Margaritopsis pribiloffensis* (Dall) from 741 feet.

Fig. 11.—*Solariella obscura* (Couthouy) from 132 feet, umbilical view.

Fig. 12.—*Margaritopsis ? grosvenori* (Dall) from 175 feet.

Magnification: All × 2.7.



Cancellariidae, Neptuneidae, Fissurellidae, Trochidae, and Lucinidae. Explanation on facing page.

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Explanation of Plate 3

Fig. 1.—*Dendronotus frondosus* (Ascanius), washed ashore in September 1949.

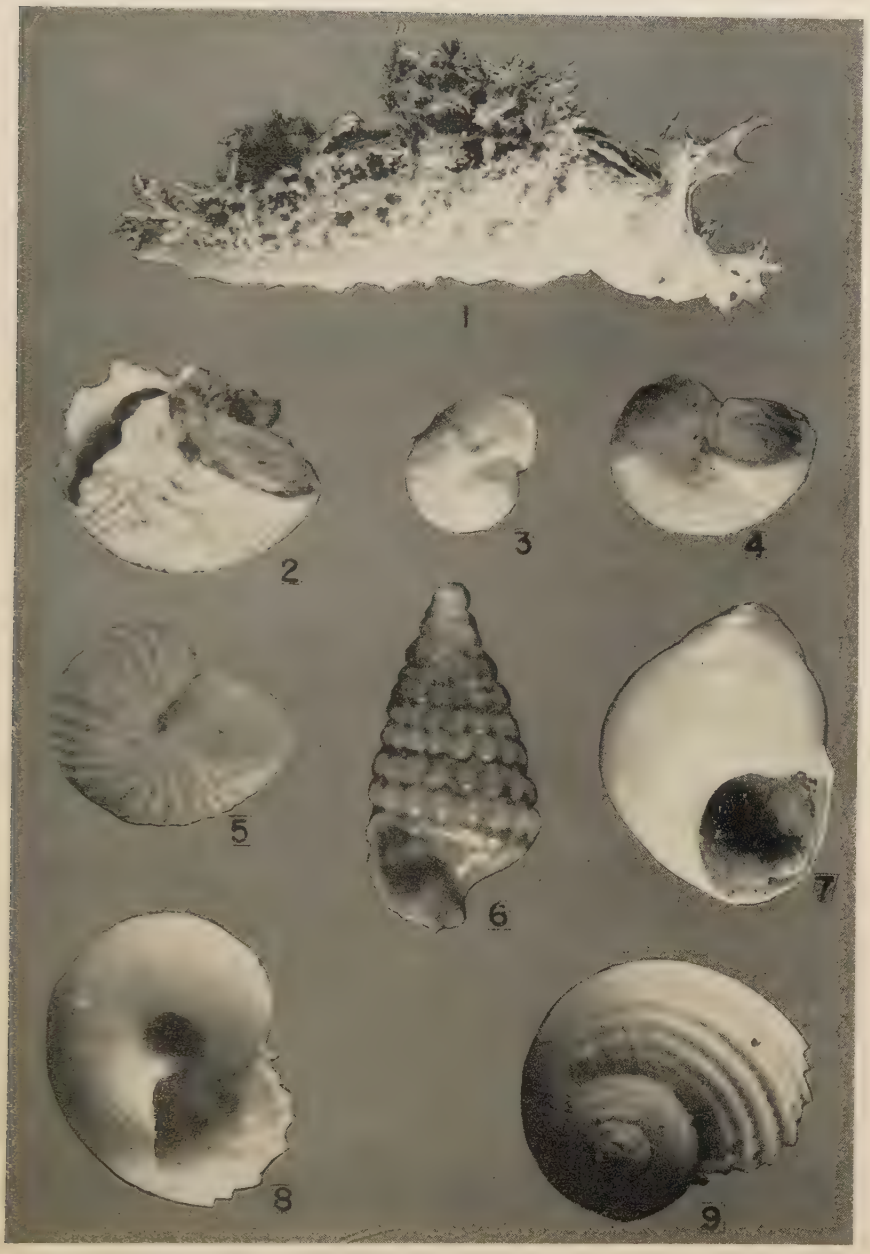
Figs. 2–5.—*Molleria costulata* (Möller): 2, from 741 feet, showing a form with many fine ribs interrupted by a prominent carina that outlines the umbilicus; 3, 4, from 453 and 477 feet, respectively, forms in which the axial sculpture consists almost entirely of incremental lines but with widely spaced evanescent axial riblets posterior to the carina outlining the umbilicus; shallow depressions between the riblets; 5, from 453 feet, showing a form with fewer and much coarser ribs than in 2; ribs uninterrupted because of no carina outlining the umbilicus.

Fig. 6.—*Triphora perversa* (Linnaeus) from 341 feet, an immature specimen.

Fig. 7.—*Margarites frigidus* Dall from 420 feet.

Figs. 8, 9.—*Margarites avenosooki*, new species, from 341 feet: 8, umbilical view, showing rounded shoulder and steplike cords on the base; 9, apical view.

Magnification: 1, × .86; 2–5 × 16.7; 6, × 18.6; 7. × 6.5; 8, 9, × 13.6.



Dendronotidae, Liotiidae, Triphoridae, and Trochidae. Explanation on facing page.

Explanation of Plate 4

Figs. 1, 1a.—*Lepeta caeca* (Müller) from 132 feet: 1, apical view; 2, side view, showing straight anterior and convex posterior ends.

Figs. 2, 7.—*Puncturella noachina* (Linnaeus) from 184 feet: 2, interior view, showing props at sides of septum and depressions in front of them; 7, side view, showing straight anterior and convex posterior ends.

Fig. 3.—*Cylichna occulta* (Mighels) from plankton tow near shore (net touching bottom), July 13, 1950.

Figs. 4, 5.—*Margaritopsis ? grosvenori* (Dall) from 175 feet.

Fig. 6.—*Retusa umbilicata* (Montagu) from 477 feet, a specimen without an umbilical perforation.

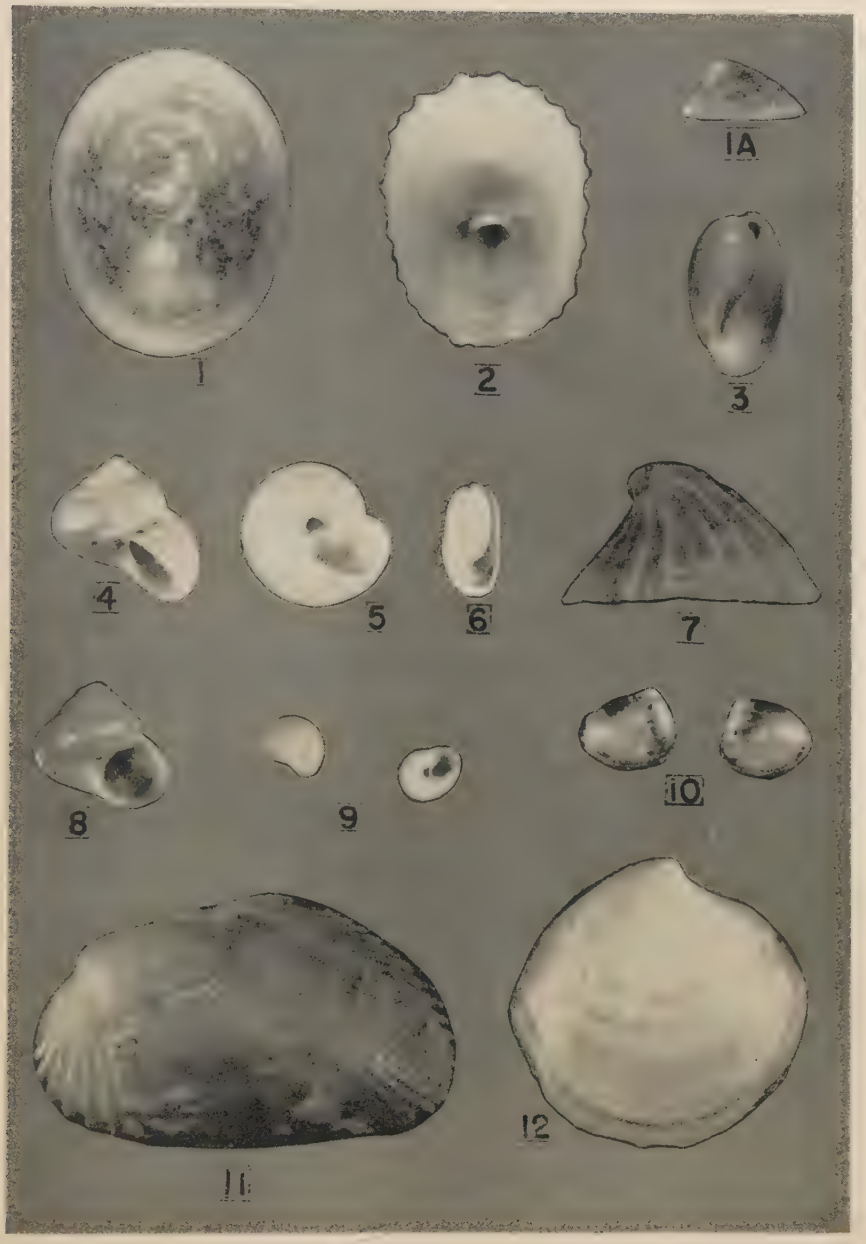
Figs. 8, 9.—*Margarites vahli* Möller: 8, from 477 feet; 9, from 184 feet.

Fig. 10.—*Mysella sovaliki*, new species, from 741 feet, left and right valve, respectively.

Fig. 11.—*Musculus corrugatus* (Stimpson) from 204 feet, a young specimen 7.3 mm. long.

Fig. 12.—*Thyasira flexuosa* (Montagu) var. *sarsi* Philippi from 162 feet.

Magnification: 1, × 4; 1a, × 1.6; 2, 3, × 5.5; 4–6, 10, × 5.4; 7–9, × 5.3; 11, × 7.5; 12, × 6.4.



Lepetidae, Fissurellidae, Scaphandridae, Trochidae, Acteocinidae, Leptonidae, Mytilidae, and Thyasiridae. Explanation on facing page.

Explanation of Plate 5

Fig. 1.—*Admete regina* Dall from 522 feet.

Figs. 2, 3.—*Epitonium greenlandicum* (Perry): 2, from 152 feet; 3, from 216 feet, shown with its operculum.

Figs. 4–6.—*Piliscus commodus* (Middendorff). 4, from 125 feet, external view. 5, from 125 feet, showing all white interior. 6, from 175 feet, internal view of specimen with radiating reddish stripes.

Fig. 7.—*Crepidula grandis* Middendorff from 217 feet, showing strongly curved apex.

Fig 8.—*Beringius beringi* (Middendorff) from 152 feet, a specimen only recently escaped from the egg capsule (see pl. 12).

Fig. 9.—*Tachyrhynchus reticulatum* (Mighels) from 438 feet.

Fig. 10.—*Ptychatractus occidentalis* Stearns from 438 feet.

Magnification: All × 1.3.

Cancellariidae, Epitoniidae, Lamellariidae, Crepidulidae, Neptuneidae, Turritellidae, and Fusinidae. Explanation on facing page.

Explanation of Plate 6

Figs. 1–3.—*Velutina undata* Brown from 204, 453, and 453 feet, respectively; all probably forma typica.

Fig. 4.—*Velutina velutina* (Müller) from 453 feet, showing the longitudinal cuticular ridges characteristic of this species.

Fig. 5.—*Velutina velutina* var. *schneideri* Friele from 741 feet, showing the smoother cuticulum and evidence of a thin calcareous layer.

Fig. 6.—*Velutina plicatilis* (Müller) from 175 feet, view of interior.

Fig. 7.—*Velutina lanigera* (Möller) washed ashore Sept. 12, 1949.

Fig. 8.—*Velutina plicatilis* (Müller) washed ashore August 1948, view of exterior.

Figs. 9, 10.—*Velutina plicatilis*, var. *cryptospira* Middendorff: 9, washed ashore Oct. 5, 1949; 10, washed ashore Aug. 21, 1949, showing sunken apex covered by cuticulum.

Magnification: All × 2.

Lamellariidae. Explanation on facing page.

Explanation of Plate 7

Figs. 1, 2.—*Boreotrophon clathratus* (Linnaeus): 1, from 110 feet (USNM 606203); 2, from 125 feet.

Fig. 3.—*Boreotrophon clathratus* var. *scalariformis* Gould from 184 feet, showing the more prominent varices, which, because of chipping, always appear roughly crenulate.

Figs. 4–7.—*Boreotrophon clathratus* var. *gunneri* Lovén: 4, from 453 feet; 5, from 152 feet; 6, from 741 feet (shown with its operculum); 7, from 125 feet. These specimens show a varying number of varices and varying degrees of angularity at the shoulder.

Figs. 8–10.—*Boreotrophon truncatus* (Strøm), var.? from 125, 152, and 152 feet, respectively. Specimens shown in 8 and 9 have a longer canal than typical *truncatus*.

Figs. 11, 12.—*Boreotrophon beringi* (Dall): 11, washed ashore Sept. 20, 1949; 12, from 453 feet.

Figs. 13, 14.—*Boreotrophon pacificus* (Dall): 13, washed ashore Aug. 21. 1949; 14, from 132 feet.

Magnification: All × 1.5.

Muricidae. Explanation on facing page.

Explanation of Plate 8

Fig. 1.—*Margaritopsis pribiloffensis* (Dall) from 741 feet.

Fig. 2.—*Margaritopsis ? grosvenori* (Dall) from 175 feet, apical view, showing the fine spiral lirae and the deep sutures.

Figs. 3, 4, 7, 9.—*Boreotrophon truncatus* (Strøm): 3, from 217 feet, aboral view of specimen in which the entire spire is covered with *Syncoryne* sp.; 4, 9, oral and aboral views of specimen from 741 feet; 7, aboral view of specimen from 120 feet (Sept. 15, 1948) from foliaceous bryozoan.

Figs. 5, 6.—*Odostomia cassandra* Dall and Bartsch: 5, oral view of adult from 140 feet; 6, aboral view of immature specimen from 453 feet.

Fig. 8.—*Raphitoma amoena ?* Sars from 184 feet, aboral view showing the spiral folds.

Magnification: 1, × 5.6; 2, × 13; 3, × 5.3; 4, × 3.5; 5, × 12.5; 6, × 22; 7, × 4; 8, × 11; 9, × 3.1.

Trochidae, Muricidae, and Pyramidellidae. Explanation on facing page.

Explanation of Plate 9

Figs. 1–6.—*Buccinum glaciale* Linnaeus: 1, from 150 feet, showing characteristics close to those of typical *B. glaciale;* 2, from 522 feet, showing one faint carina, rounded shoulder, and fairly weak axial folds; 3, from 184 feet, showing stronger axial folds, one carina, a slight keel at the shoulder, and gradually expanding whorls; 4, from 125 feet, the most common form at Point Barrow, showing axial folds, one strong carina, a keel at the shoulder, a base flatter than in the preceding specimens, and more rapidly expanding whorls; 5, from 80 feet (Apr. 12, 1950), characterized by moderate axial folds, a long slender spire and flat whorls; 6, from 125 feet, characterized by a long, very slender spire, a short aperture, a mere suggestion of a carina, and rounded shoulder and base.

Figs. 7, 10, 13.—*Buccinum glaciale* var. *morchianum* Dunker: 7, an immature specimen from 213 feet exhibiting a strong shoulder; 10, a young specimen from 522 feet showing a faint carina and a weak shoulder; 13, a mature specimen from 453 feet with 2 carinae on the body whorl and a moderate shoulder.

Figs. 8, 9.—*Buccinum tenue* Gray: 8, from 80 feet (Apr. 18, 1950); 9, specimen with its operculum, from 110 feet (Sept. 8, 1948). The shells are usually much thinner and the spiral sculpturing much fainter than in *B. plectrum;* the interrupted nature of the axial fold gives them a wavy appearance.

Figs. 11, 12.—*Buccinum plectrum* Stimpson: 11, from 125 feet; 12, from 522 feet. Typical specimens.

Magnification: All about same size.

Buccinidae. Explanation on facing page.

Explanation of Plate 10

Fig. 1.—*Buccinum polare* var. *orotundum* Dall from 80 feet (Mar. 20, 1950), showing the tumid body whorl.

Figs. 2, 3.—*Buccinum polare* Gray varieties from 64 feet (May 15 and May 17, 1950, respectively), showing variation in axial folds and spiral sculpture. (These may be immature specimens of var. *orotundum*.)

Fig. 4.—*Buccinum polare* Gray, with its operculum, from 64 feet (May 17, 1950), near the typical in form.

Fig. 5.—*Buccinum undatum* var. *striatum* Pennant from 477 feet.

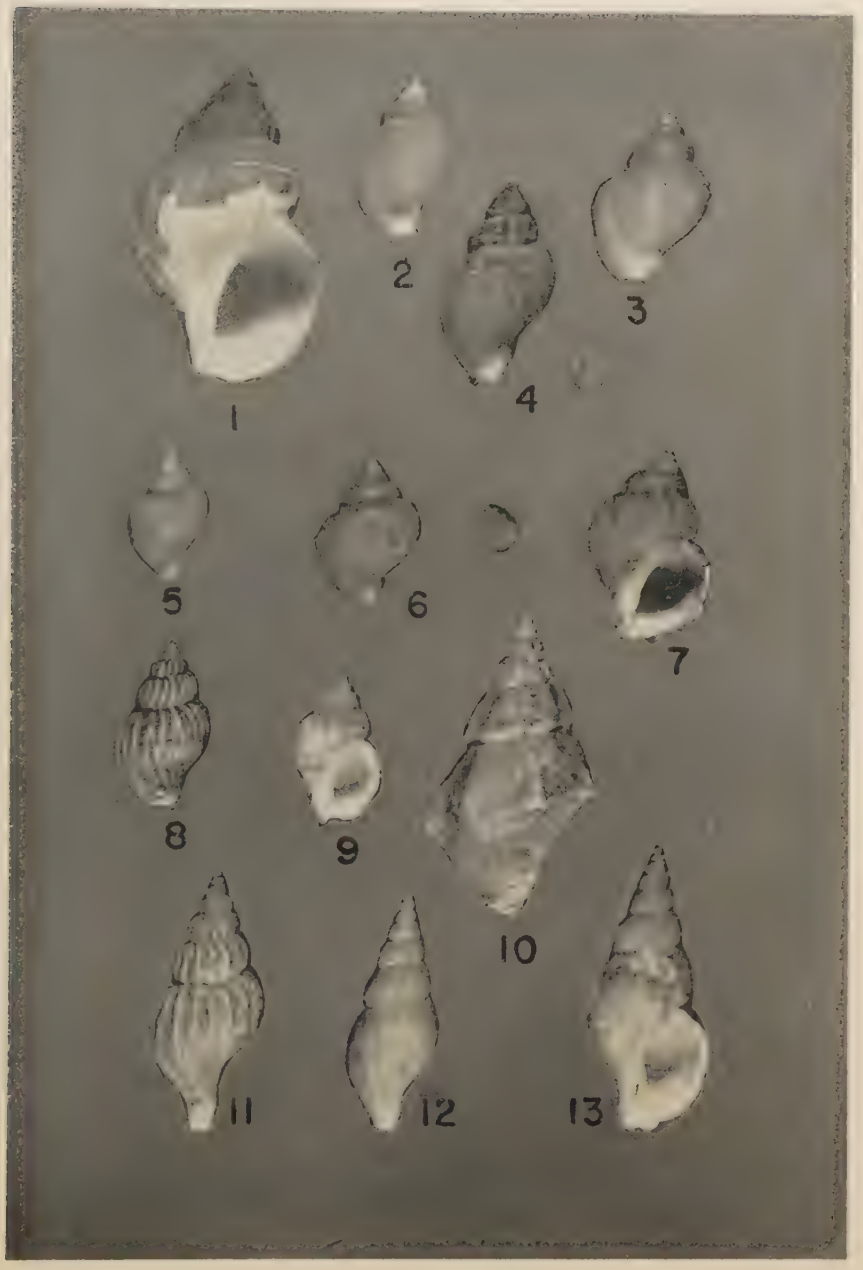
Figs. 6, 7.—*Buccinum fringillum* Dall from 453 feet.

Figs. 8, 9.—*Buccinum ciliatum* Fabricius from 162 and 341 feet, respectively.

Fig. 10.—*Buccinum angulosum* Gray, typical form, a young adult from Eluitkak Pass (Aug. 10, 1948).

Figs. 11–13.—*Plicifusus kroyeri* (Möller): 11, a typical *P. kroyeri* from 125 feet; 12, 13, slenderer forms, from 420 feet, with weak axial folds and microscopic spiral sculpture.

Magnification: All × .73.



Buccinidae and Neptuneidae. Explanation on facing page.

Explanation of Plate 11

Figs. 1–3.—*Buccinum angulosum* var. *normale* Dall: 1, a typical var. *normale*, from 37 feet (May 30, 1950), showing the smooth whorls with very weak axial folds only near the suture; 2, from 37 feet (May 17, 1950), showing slightly stronger axial folds; 3, from 37 feet (Mar. 10, 1950), showing a faint carina and, on the last whorl, axial ridges resulting from growth difficulties.

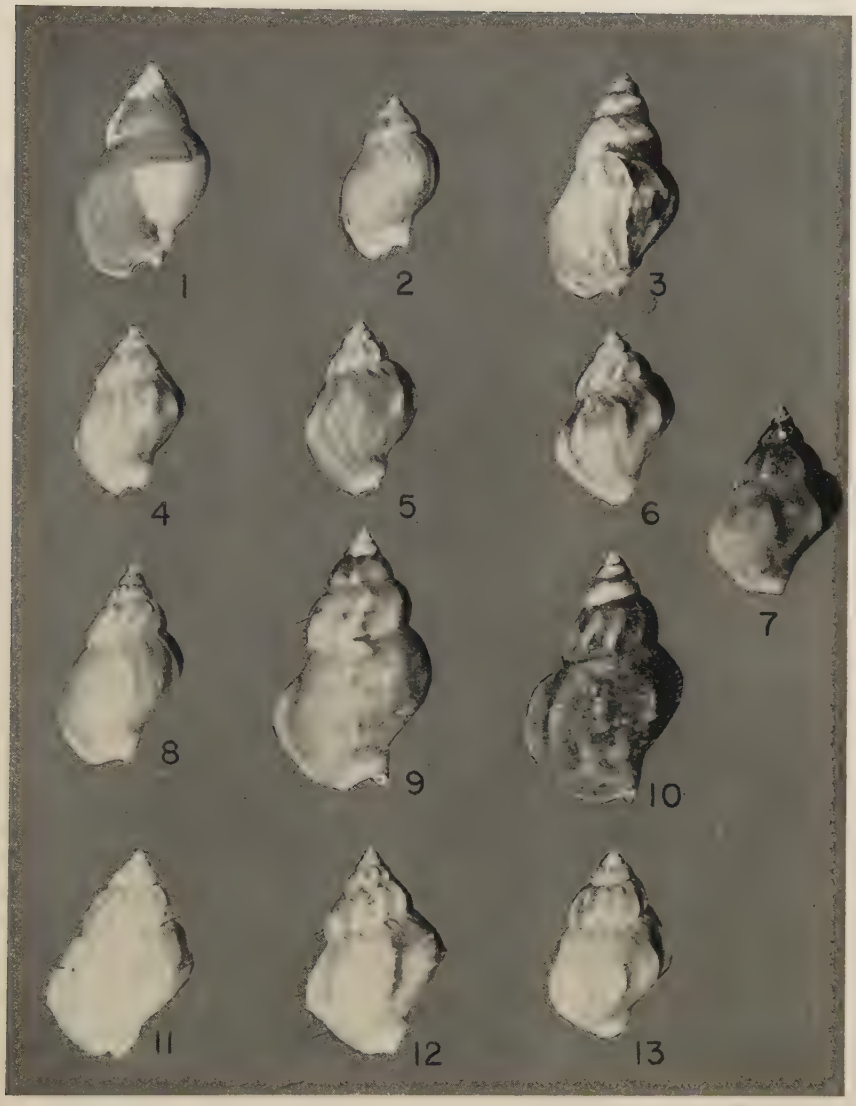
Figs. 4–6.—*Buccinum angulosum* var. *subcostatum* Dall: 4, a specimen with somewhat less pronounced longitudinal ribs than typical; 5, a typical var. *subcostatum*; 6, a specimen with strong longitudinal ribs and with a faint spiral cord. All from 37 feet (May 17, 1950).

Fig. 7.—*Buccinum angulosum* Gray, a typical young adult from 64 feet (May 17, 1950). (For mature adult, see pl. 17, fig. 5.)

Figs. 8–10.—*Buccinum angulosum* varieties: 8, a specimen from 37 feet (May 17, 1950), showing characteristics of var. *normale* (fairly smooth body whorl), var. *subcostatum* (stronger axial folds than in var. *normale*), and var. *transliratum* (a spiral cord); 9, a specimen from 64 feet (May 17, 1950), showing less of the characteristics of var. *normale* and more of those of var. *subcostatum* and var. *transliratum* (stronger axial ribs, more and stronger spiral cords than in 8). 10, a specimen washed ashore (September 1949), strongly resembling var. *subcostatum* but with spiral cords suggestive of var. *transliratum*.

Figs. 11–13.—*Buccinum angulosum* var. *transliratum* Dall: 11, a specimen from 37 feet (May 17, 1950) with three cords but with weak axial folds or ribs on last whorl; 12, a form from 37 feet (May 26, 1950), with strong axial ribs, two strong and one faint cord on the last whorl; 13, a form intermediate between var. *subcostatum* and var. *transliratum* washed ashore (September 1949).

Magnification: All × .64.



Buccinidae. Explanation on facing page.

473771—59——13

Explanation of Plate 12

Figs. 1–5.—*Beringius beringi* (Middendorff): 1, from 453 feet, showing a heavy shell with long spire and relatively short aperture; 2, a juvenile, from 152 feet, just escaped from the capsule; 3, a thinner shell, from 40 feet (Eluitkak Pass, Aug. 10, 1948), with a short spire and long aperture, shown with its operculum in place. 4, 5, young specimens, from 125 and 216 feet, respectively, showing variation in the nuclear whorls and aperture.

Fig. 6.—*Beringius beringi* var. *kobelti* Dall from 125 feet.

Fig. 7.—*Volutopsius stefanssoni* Dall from 110 feet (Sept. 8, 1948).

Fig. 8.—*Natica clausa* Broderip and Sowerby from Eluitkak Pass (Aug. 6, 1948), shown with its shelly operculum.

Fig. 9.—*Polinices monteronus* Dall from 295 feet, with its horny operculum, showing the notched callus covering the umbilicus, and the thickened pillar lip.

Fig. 10.—*Polinices pallidus* (Broderip and Sowerby) from 130 feet (Sept. 15, 1948).

Magnification: All × .7.

Neptuneidae and Naticidae. Explanation on facing page.

Explanation of Plate 13

Fig. 1.—*Beringius stimpsoni* forma *malleatus* Dall from 125 feet, a specimen that is 4-sided in the last whorls.

Fig. 2.—*Beringius stimpsoni* (Gould) from 522 feet, a specimen that is 6-sided in the last whorl.

Figs. 3–5.—*Pyrulofusus deformis* (Reeve) from 438, 120 (Sept. 15, 1948), and 130 feet (Sept. 15, 1948), respectively. The external lips of 4 and 5 are broken near the canal.

Magnification: All × .71.

Neptuneidae. Explanation on facing page.

Explanation of Plate 14

Figs. 1–6.—*Neptunea ventricosa* (Gmelin): 1, a "ventricose" form from 120 feet (Sept. 15, 1948), with flat whorls, showing the two carinae and the cylindrical nucleus; 2, from 420 feet, shown with its operculum; 3, a long-spired form (USNM 606148) from 420 feet, with inconspicuous carinae and with lamellose projections on the last whorl; 4, a slender form (USNM 606150) from 453 feet; 5, a nodulous form (USNM 606149) from 341 feet, with evanescing carinae and more convex whorls; 6, a young specimen (USNM 606151) from 152 feet.

Figs. 7–10.—*Neptunea middendorffiana*, new name: 7, aboral view of paratype (USNM 606142) from 420 feet, a form in which the carina is nearer the posterior end of the whorl; 8, oral view of holotype (USNM 602694) from 175 feet, with the carina nearer the anterior end of the whorl (shown with its operculum); 9, young specimen (USNM 606132) from 120 feet (Aug. 8, 1949); 10, a nodulous specimen (USNM 602688) from 125 feet, with the carina in the middle of the whorls, and with near-lamellose ridges on the last whorl.

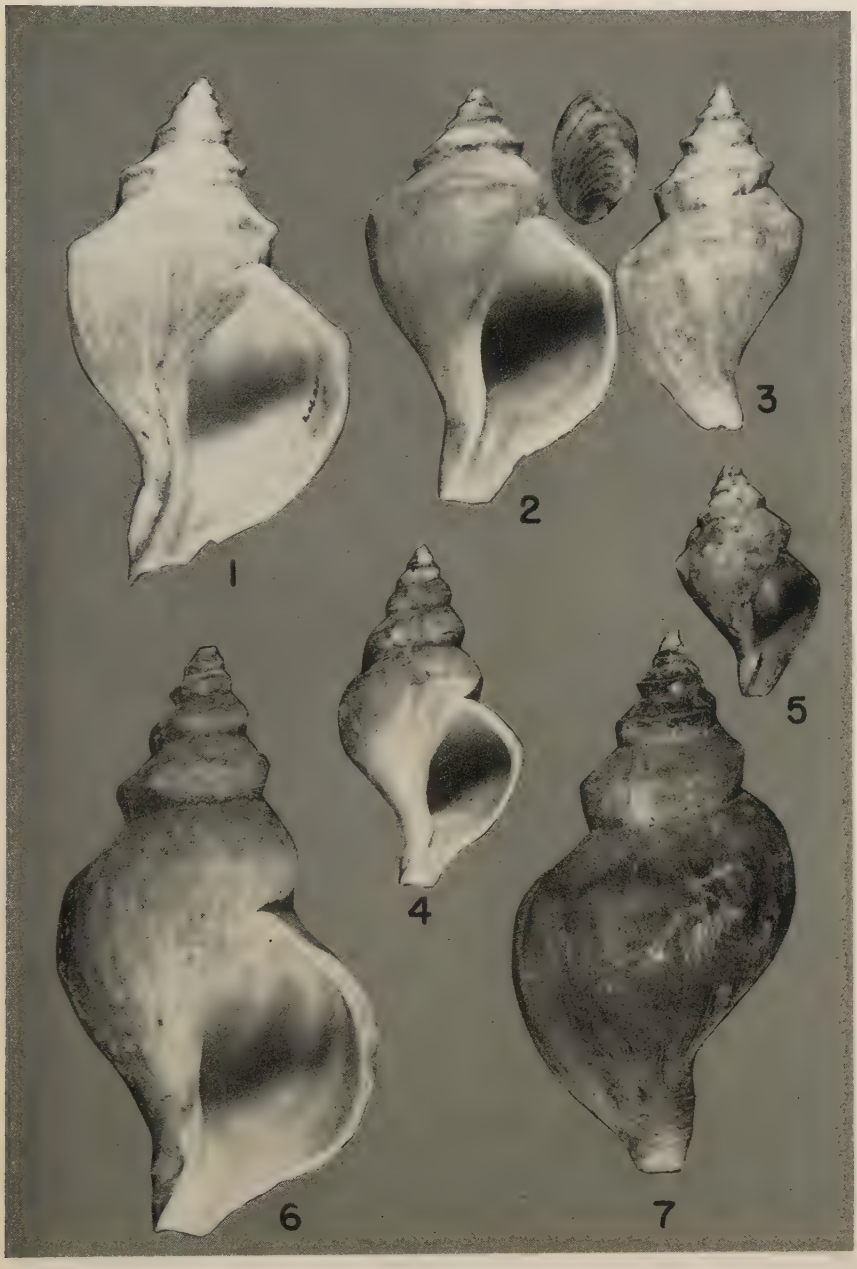
Magnification: All × .75.

Neptuneidae. Explanation on facing page.

Explanation of Plate 15

Figs. 1–7.—*Neptunea heros* Gray: 1, a shell from 40 feet (Eluitkak Pass, Aug. 10, 1948) with a long aperture and medium spire, a strong carina and weak nodules; 2, shell from same depth and locality with a long aperture and very short spire, a strong carina and elongated nodules (shown with its operculum); 3, shell (washed ashore) with a long aperture, a fairly long spire, a strong carina, and prominent nodules; 4, a very slender form from 522 feet with a long spire, an unusually weak carina, and scarcely perceptible nodules; 5, a young specimen from Eluitkak Pass, similar to No. 3; 6, a long-spired form from 522 feet with moderately developed carina and nodules, both of which are practically lacking in the last whorl; 7, shell from 741 feet, similar to No. 6, but with a shorter spire and weaker nodules.

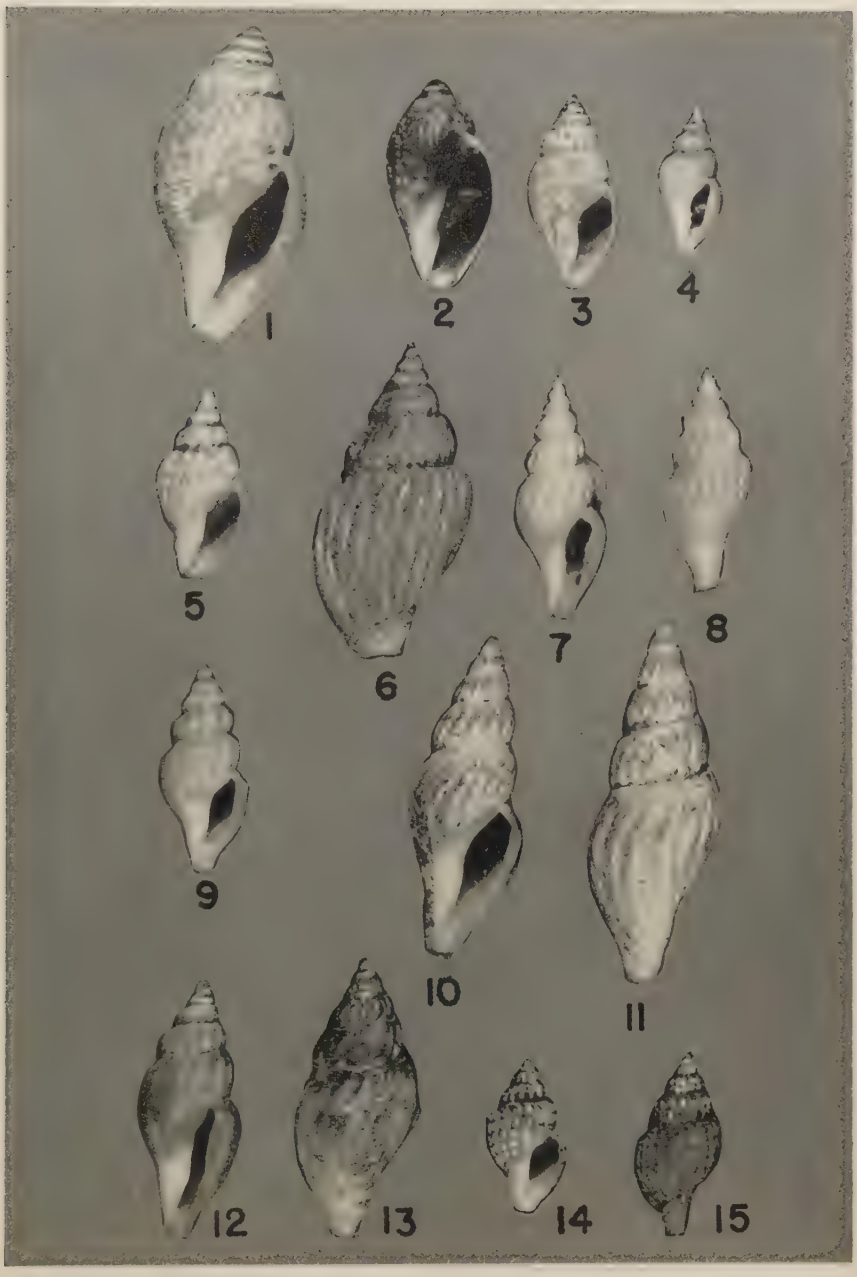
Magnification: All × .75.



Neptuneidae. Explanation on facing page.

Explanation of Plate 16

Fig. 1.—*Obesotoma tenuilirata* (Dall) from 132 feet.
Fig. 2.—*Obesotoma simplex* (Middendorff) washed ashore Sept. 12, 1949.
Fig. 3.—*Oenopota nazanensis* (Dall) from 216 feet.
Fig. 4.—*Oenopota tenuicostata* (M. Sars) from 420 feet.
Figs. 5, 6.—*Oenopota harpa* (Dall) from 420 and 110 feet (Sept. 16, 1948), respectively.
Figs. 7, 8.—"*Oenopota*" *elegans* (Möller) from 152 and 204 feet, respectively.
Fig. 9.—"*Oenopota*" *harpularia* (Couthouy) from 130 feet (Aug. 9, 1949).
Figs. 10, 11.—"*Oenopota*" *pyramidalis* (Strøm) from 453 and 295 feet, respectively.
Figs. 12, 13.—"*Oenopota*" *pyramidalis* var. *semiplicata* G. Sars from 152 and 216 feet, respectively.
Figs. 14, 15.—*Nodotoma impressa* (Mörch) from 295 and 477 feet, respectively.
Magnification: All × 2.56.



Turridae. Explanation on facing page.

Explanation of Plate 17

Figs. 1, 2.—*Symmetrogephyrus vestitus* (Broderip and Sowerby): 1, a specimen from 295 feet with many tufts of hairs; 2, a specimen from 522 feet with sparse tufts of hairs.

Figs. 3, 4.—*Trachydermon albus* (Linnaeus), a dark and a light form, respectively. from 217 feet.

Fig. 5.—*Buccinum angulosum* Gray, a typical adult specimen from 522 feet.

Figs. 6, 7.—"*Oenopota*" *pyramidalis* var. *vahli* Möller from 217 feet.

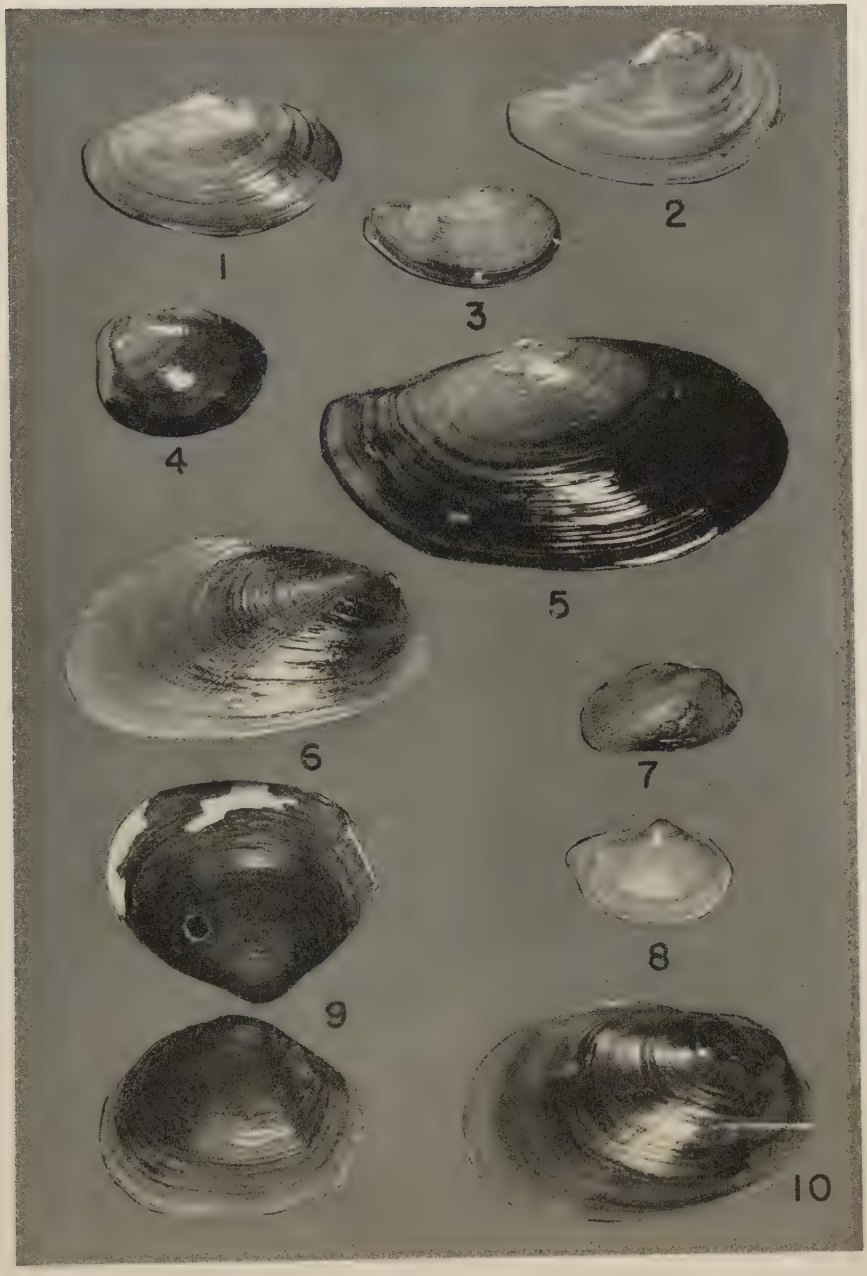
Figs. 8, 9.—*Cingula castanea* Möller var. *alaskana* Dall: 8, a juvenile from 341 feet, with egg capsules on shell; 9, an adult from 477 feet.

Magnification: 1–5, × 1.1; 6, 7, × 5.4; 8, × 23.7; 9, × 11.9.

Cryptochitonidae, Lepidochitonidae, Buccinidae, Turridae, and Rissoidae. Explanation on facing page.

Explanation of Plate 18

Fig. 1.—*Yoldia myalis* (Couthouy) from 118 feet.
Fig. 2.—*Nuculana radiata* (Krause) from 80 feet (Aug. 21, 1948).
Fig. 3.—*Nuculana minuta* (Fabricius) from 522 feet.
Fig. 4.—*Nucula tenuis* Montagu from 118 feet.
Fig. 5.—*Yoldia hyperborea* Torrell ex Lovén from 132 feet.
Fig. 6.—*Musculus niger* (Gray) from 204 feet.
Fig. 7.—*Musculus corrugatus* (Stimpson) from 175 feet.
Fig. 8.—*Yoldia arctica* (Gray) from 28 feet (Aug. 4, 1948).
Fig. 9.—*Thracia* (*Lampeia*) *adamsi*, new subgenus, new species, from 110 feet (Sept. 15, 1948).
Fig. 10.—*Musculus discors* var. *laevigatus* Gray from 40 feet (Eluitkak Pass, Aug. 1, 1950).
Magnification: All × 1.56.



Nuculanidae, Nuculidae, Mytilidae, and Thraciidae. Explanation on facing page.

Explanation of Plate 19

Fig. 1.—*Panomya arctica* (Lamarck) from Unimak Pass in the Aleutians, exterior of right valve.

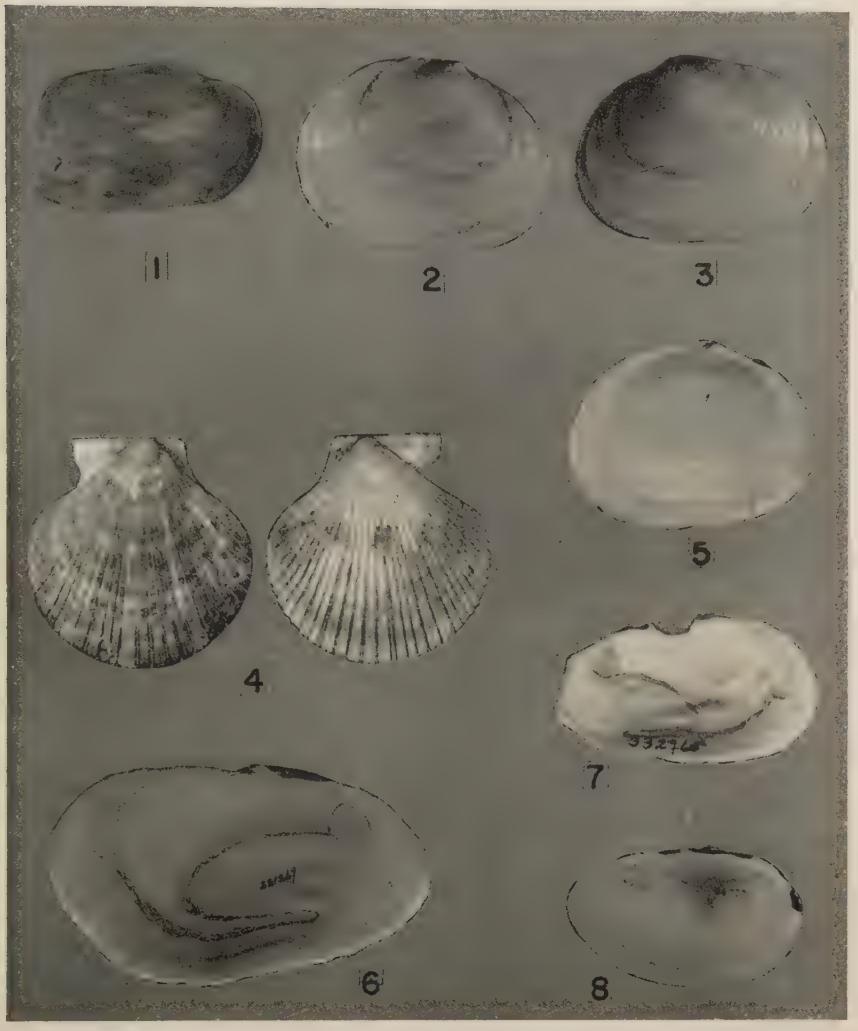
Figs. 2, 3, 5.—*Pseudopythina compressa* Dall washed ashore Aug. 27, 1949: 2, exterior of right valve, showing spinules on dorsal margin; 3, exterior of left valve; 5, interior of left valve.

Fig. 4.—*Chlamys islandica* (Müller) from 420 feet: left, exterior of left valve; right, exterior of right valve.

Figs. 6, 8.—*Mya japonica* Jay: 6, Dall's lectotype of *Mya intermedia*, from Chignik Bay (east side of the Alaska Peninsula), showing extreme development of anterior end and pallial sinus; 8, from Tokyo Bay, Japan (from the Stanford Collection), showing pallial sinus no deeper than that of *M. arenaria*.

Fig. 7.—*Mya pseudoarenaria* Schlesch from the Arctic (Sta. 24, Canadian Arctic Expedition), a specimen formerly assigned to *M. intermedia*.

Magnification: 1, × .33; 2, 3, 5, × 2.8; 4, 6, × .46; 7, × 1.4; 8, × .35.



Hiatellidae, Leptonidae, and Myacidae. Explanation on facing page.

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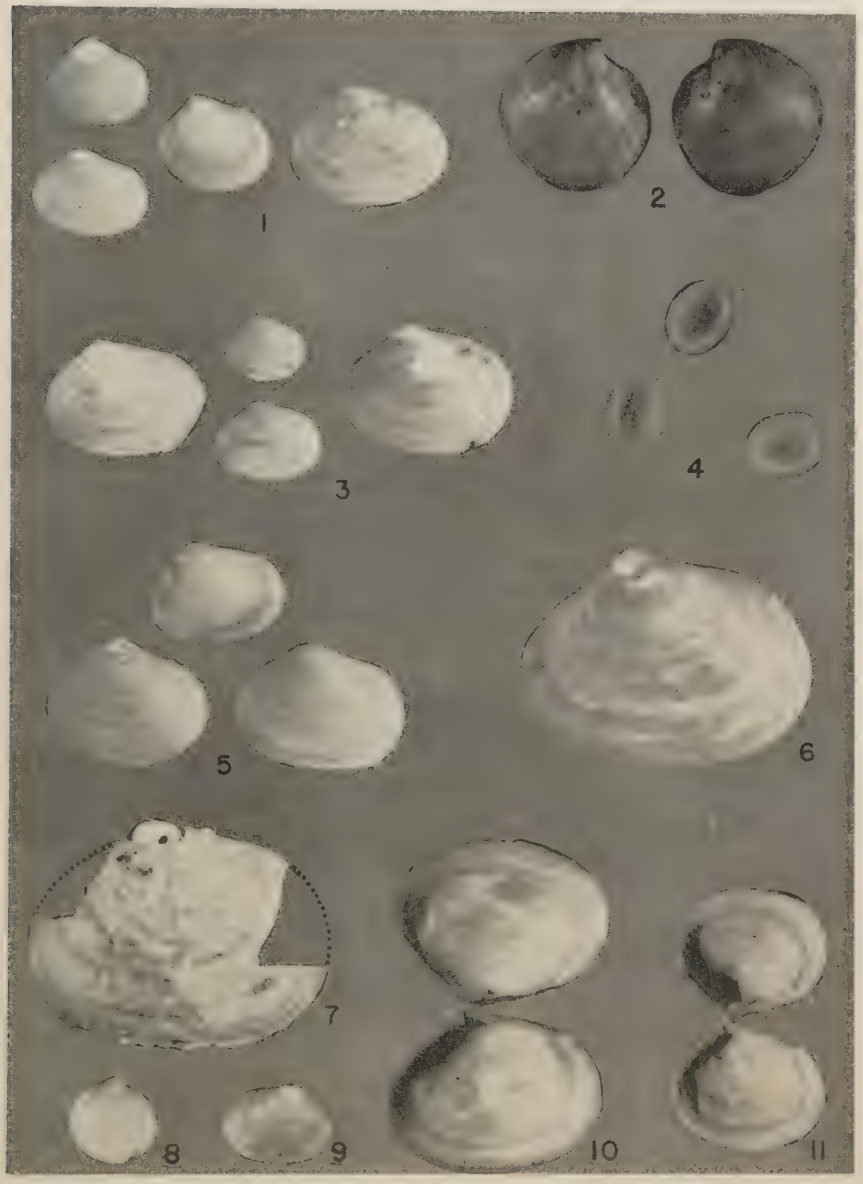
Explanation of Plate 20

Figs. 1, 3–7, 9–11.—*Montacuta planata* (Dall): 1, a group of 4 specimens from Greenland; 3, a group of 4 specimens (USNM 159303) of Dall's cotypes of *Mysella planata* from Plover Bay; 4, embryos from a specimen (4.5 x 3.4 x 2.0 mm.) from 328 feet, Point Barrow, Alaska; 5, a group of 3 specimens (USNM 333648) of Dall's *Mysella molleri* (Mörch) from Greenland; 6, Dall's figured type of *Mysella planata* (USNM 159310) from the Shumagins; 7, portion of right valve of a specimen from 477 feet, Point Barrow, Alaska, with thinner shell, and smaller hinge structures than No. 6, being possibly a variant of *Montacuta planata;* 9, right valve of *M. planata* from 477 feet; 10, 11, views of interiors of specimens from Greenland (10, showing the resilium in place; 11, showing the hinge without the resilium).

Fig. 2.—*Axinopsida orbiculata* (G. Sars) from 120 feet (Aug. 8, 1949).

Fig. 8.—*Diplodonta aleutica* Dall, juvenile from 741 feet.

Magnification: 1, 3, 5, 10 × 4.6; 2, × 6; 4, × 17.7; 6, 9, × 4.5; 7, × 6.1; 8, 11, × .44.



Leptonidae, Thyasiridae, and Ungulinidae. Explanation on facing page.

Explanation of Plate 21

Figs. 1–3.—*Macoma moesta* (Deshayes): 1, right valve, Dall's figured type of *Macoma krausei*, from off Icy Cape, Alaska; 2, 3, specimens from Dall's type lot of *Macoma krausei*.

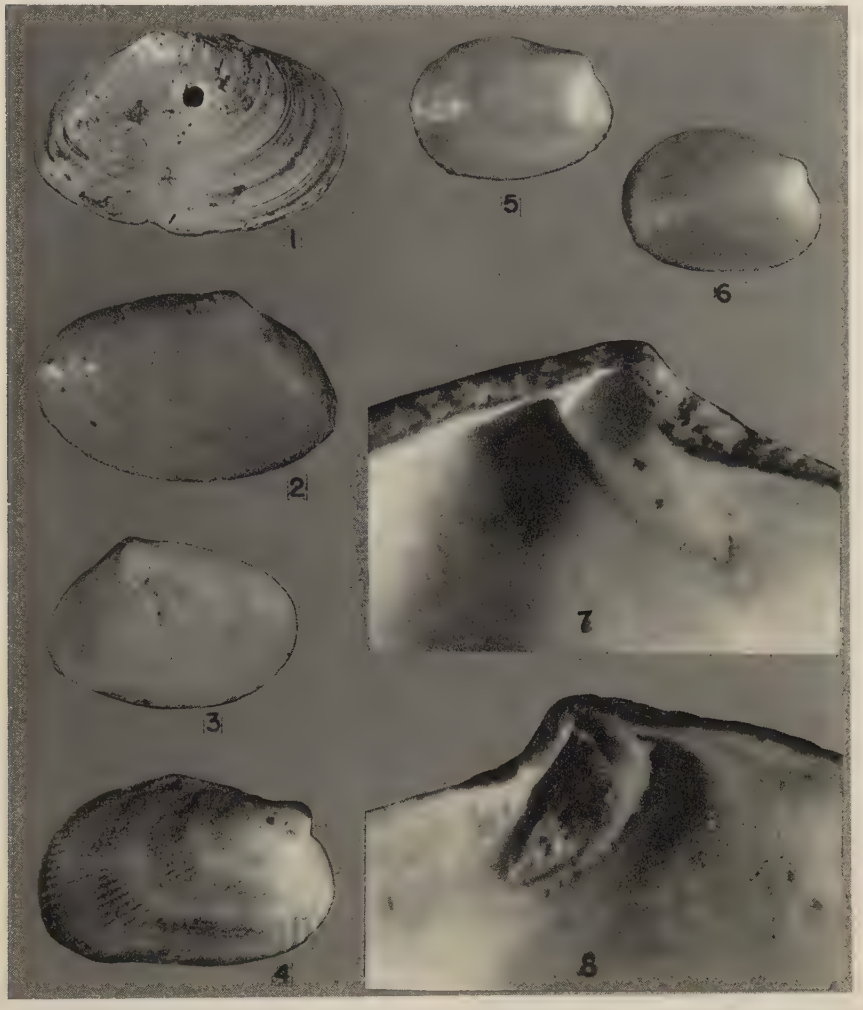
Fig. 4.—*Musculus corrugatus* (Stimpson), a juvenile from 204 feet.

Fig. 5.—*Musculus discors* (Linnaeus) var. *laevigatus* Gray, a juvenile from 477 feet.

Fig. 6.—*Musculus niger* (Gray), a juvenile from 477 feet.

Figs. 7, 8.—*Thracia adamsi*, new species, from 110 feet (Sept. 15, 1948), interior views of hinge area: 7, right valve, showing long, buttressed resilifer; 8, left valve, showing resilifer with portion of resilium in place.

Magnification: 1, × 1.77; 2, 3, × 3.15; 4, × 15.6; 5, 6, × 8.2; 7, 8, × 7.9.



Tellinidae, Mytilidae, and Thraciidae. Explanation on facing page.

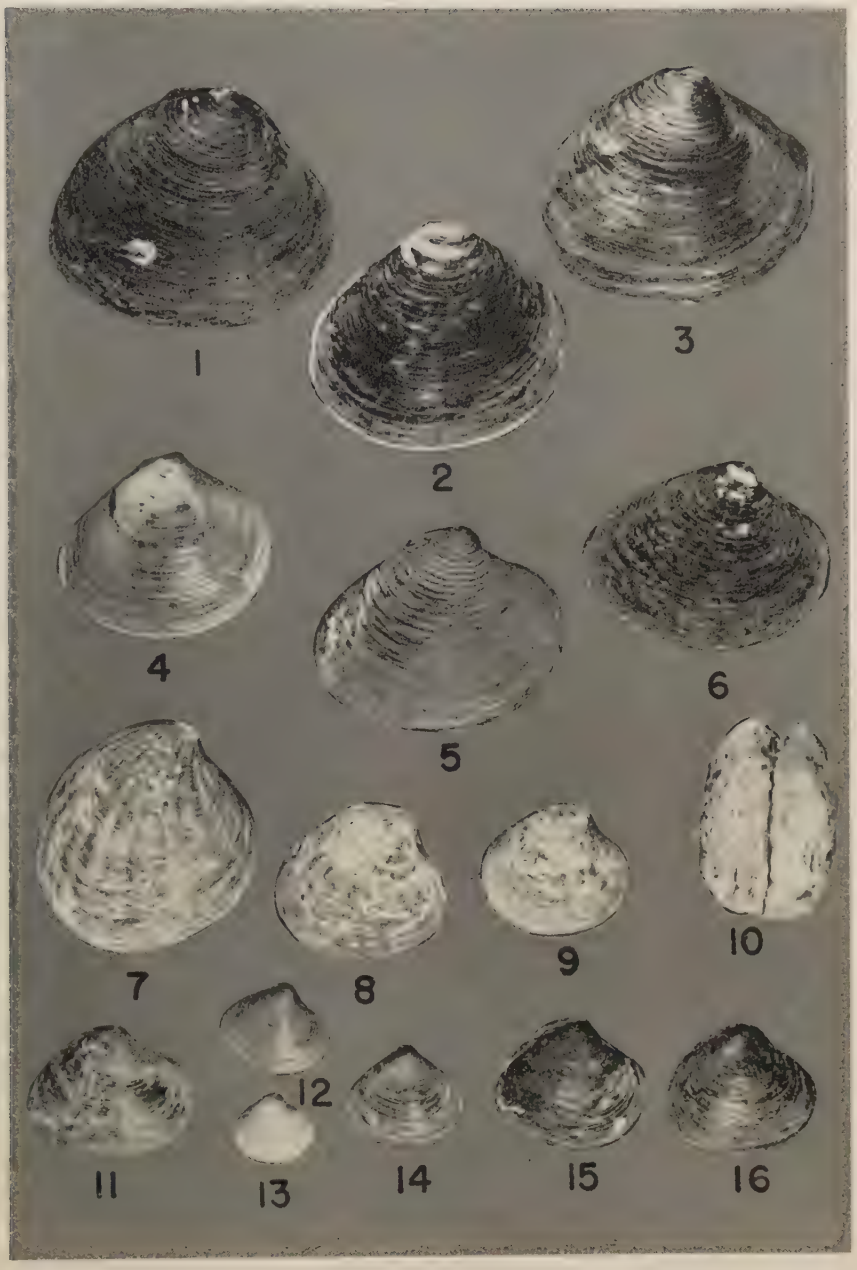
Explanation of Plate 22

Figs. 1–6.—*Astarte borealis* Schumacher, showing variations in shapes of anterior and posterior ends, in the ventral line, in sculpture, and in the proportion of height to length: 1, 2, from 40 feet (Eluitkak Pass, Aug. 10, 1948); 3–5, from 120 feet (Aug. 8, 1949); 6, from 40 feet (Eluitkak Pass, Aug. 1, 1950).

Figs. 7–10.—*Cardita crassidens* (Broderip and Sowerby): 7, a high form from 110 feet (Sept. 8, 1948); 8, an intermediate form from 130 feet (Aug. 9, 1949); 9, an elongate form (= forma *paucicostata*), from same haul; 10, a specimen that grew in cramped quarters, producing a boxlike shape, from same haul.

Figs. 11–16.—*Astarte montagui* (Dillwyn) vars.: 11, var. *warhami* Hancock, a typical var. *warhami*, from 204 feet; 12, a younger, lighter colored var. *warhami* from 125 feet; 13, a young, light colored specimen from 40 feet (Eluitkak Pass); 14–16, var. *striata* Leach from 118 feet.

Magnification: All × .83.



Astartidae and Carditidae. Explanation on facing page.

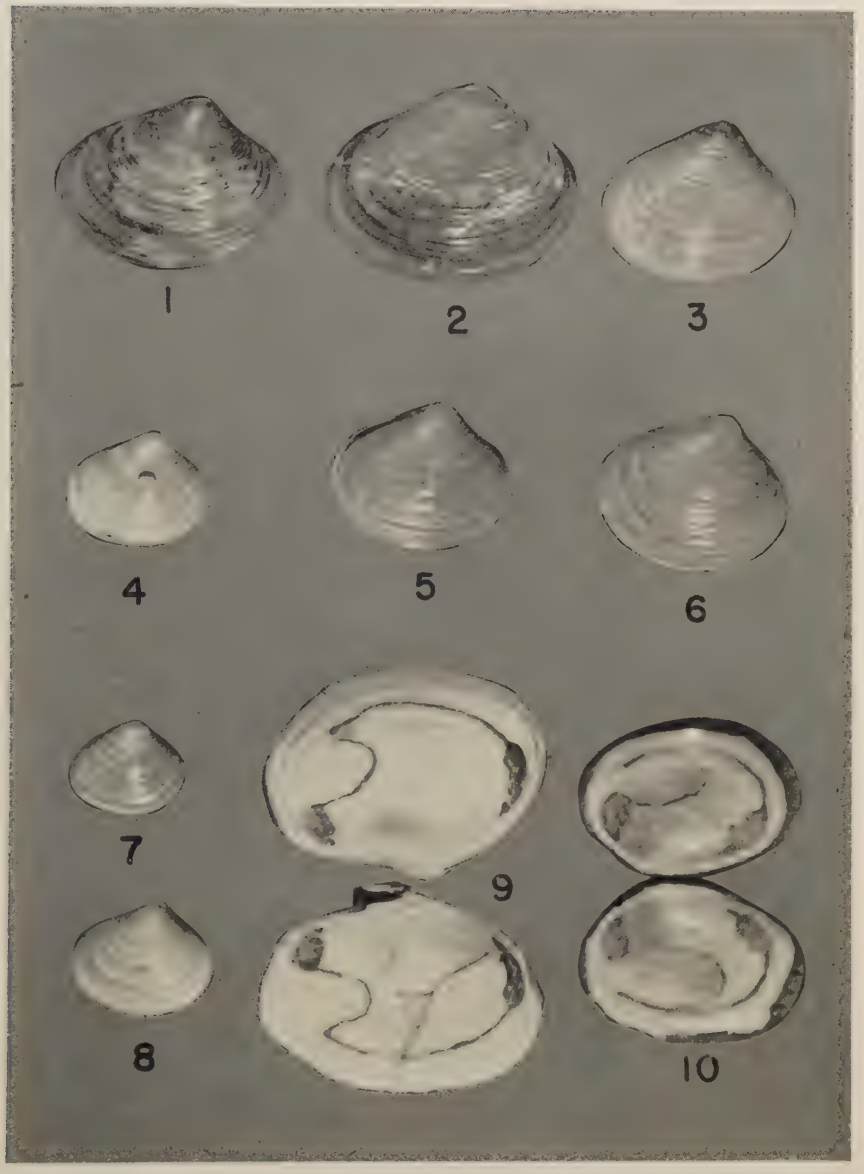
Explanation of Plate 23

Figs. 1–8.—*Liocyma fluctuosa* (Gould): 1, from 80 feet (Aug. 21, 1948), a fairly typical *L. fluctuosa* close to *L.* "*viridis*" in shape, from 80 feet (Aug. 21, 1948); 2, a specimen intermediate in shape between 1 and 3, from 246 feet; 3, a specimen that approaches the shape of *L.* "*beckii*" but lacks sufficient height, from 246 feet; 4–6, from 453, 80, and 341 feet, respectively, showing further variations in shape; 7, from 453 feet, showing concentric waves more widely spaced than in the preceding specimens; 8, from 341 feet, showing concentric waves very widely spaced.

Fig. 9.—*Thracia myopsis* (Möller): From 341 feet, interior view, showing difference in shape of sinus in right and left valves.

Fig. 10.—*Macoma moesta* (Deshayes): Interior view of specimen from 147 feet, showing difference in size of sinus in right and left valves, and the extent to which the periostracum covers the interior, especially on the anterior end.

Magnification: All × 1.2.



Tapetidae, Thraciidae, and Tellinidae. Explanation on facing page.

Explanation of Plate 24

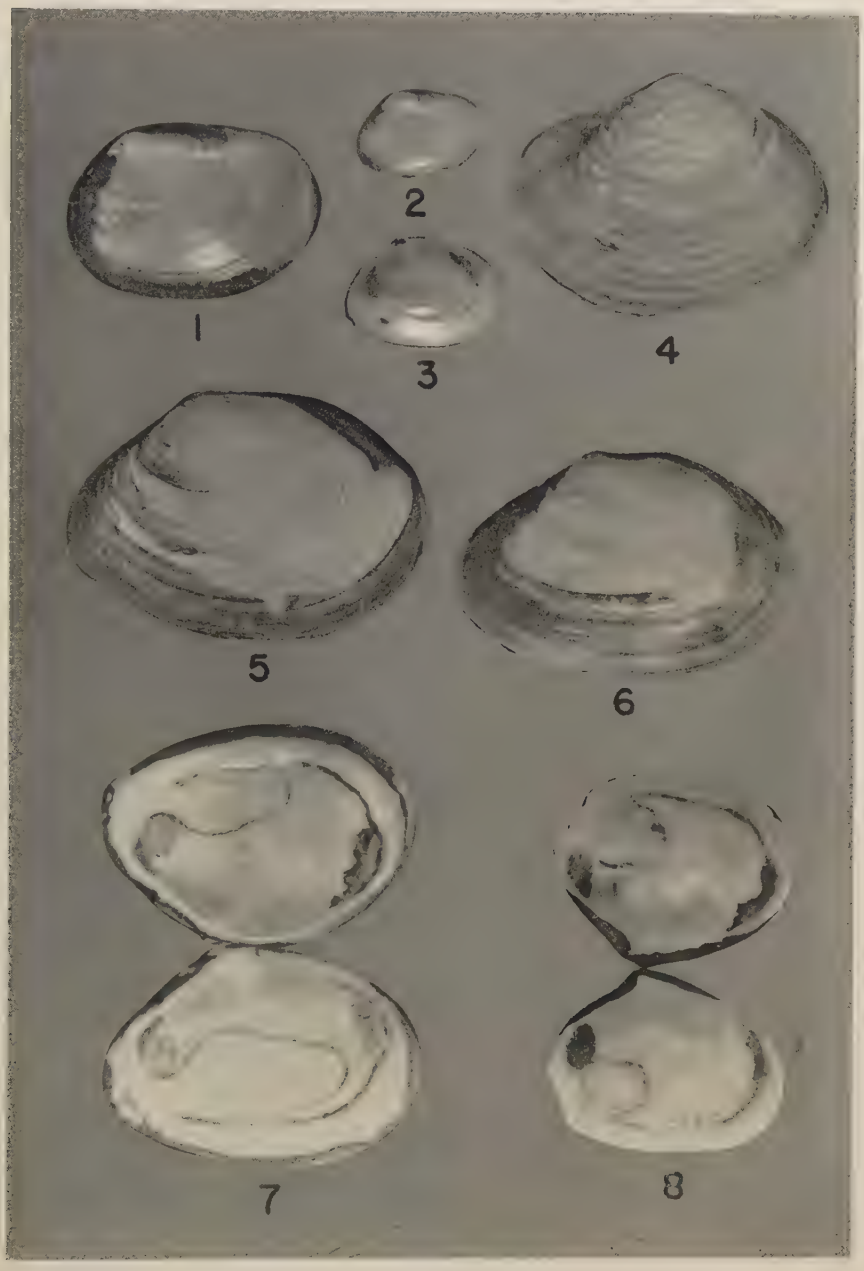
Figs. 1–3.—*Macoma moesta* (Deshayes): 1, a typical adult from 147 feet, showing the very short posterior end and the brownish concretion along the margin except at the anterior end; 2, young specimen from 522 feet, showing exterior of right valve; 3, young specimen from 80 feet (Aug. 21, 1948), showing interior of left valve.

Fig. 4.—*Thracia myopsis* (Möller), from 341 feet.

Figs. 5–7.—*Macoma calcarea* (Gmelin): 5, 6, from 72 feet, showing variation in shape and in height: length ratio; 7, from 80 feet (Aug. 21, 1948), showing variation in sinus of right and left valves.

Fig. 8.—*Thracia* (*Lampeia*) *adamsi*, new subgenus, new species, from 110 feet (Sept. 15, 1948), view of interior, showing variation in sinus of right and left valves.

Magnification: All × 1.36.



Tellinidae and Thraciidae. Explanation on facing page.

Explanation of Plate 25

Figs. 1, 2.—*Mya truncata* Linnaeus: 1, a typical *M. truncata* from Puget Sound, Wash.; 2, from Point Barrow, Alaska, with a shorter posterior end and differently shaped sinus.

Fig. 3.—*Mya truncata* var. *uddevallensis* Forbes from Point Barrow, Alaska, showing the very short posterior end and the resulting shallow sinus, also the oblique truncation that makes the ventral posterior end shorter than the dorsal.

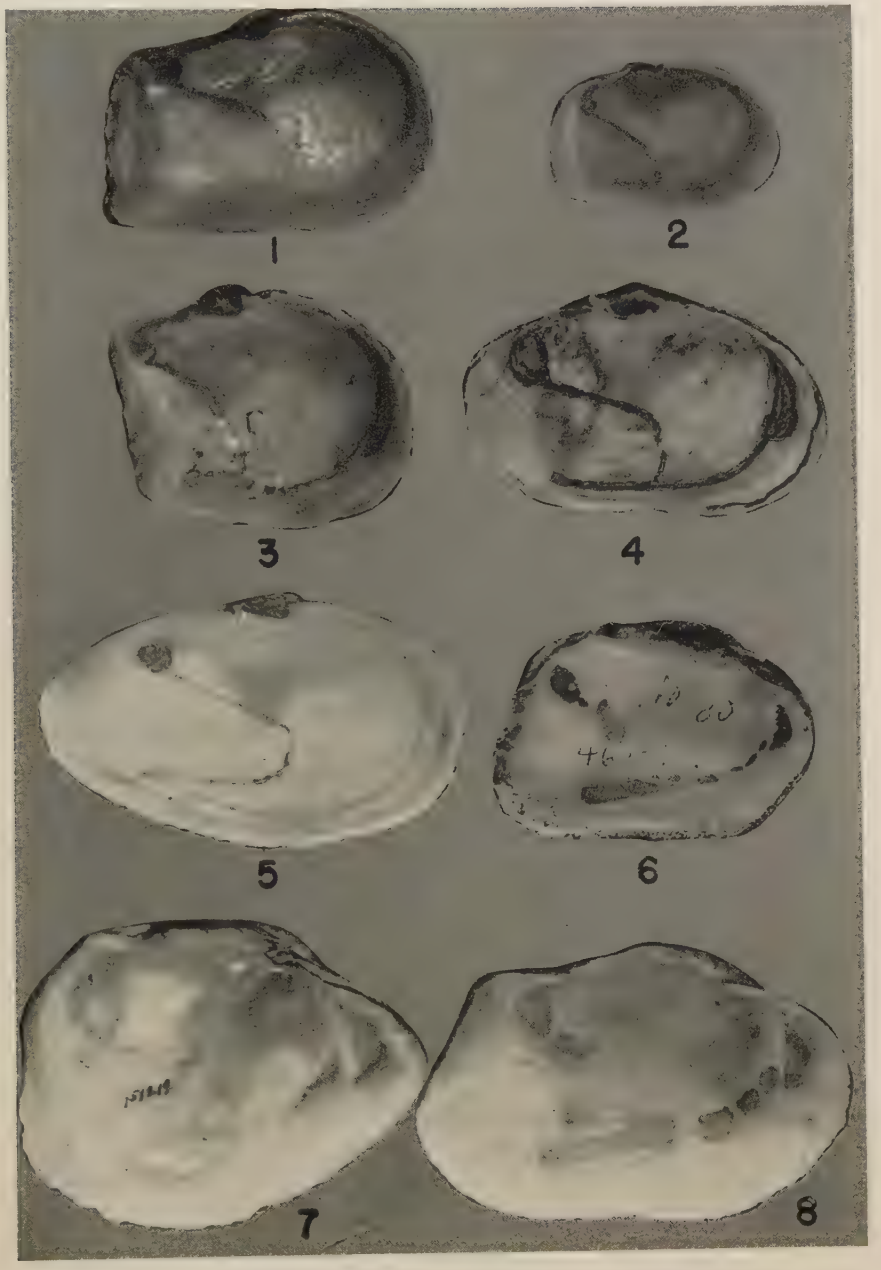
Fig. 4.—*Mya pseudoarenaria* Schlesch from Point Barrow, Alaska (Eluitkak Pass, 40 feet), showing the rounded posterior end, with a sinus similar to that of a typical *M. truncata.*

Fig. 5.—*Mya arenaria* Linnaeus from Monterey Bay (Moss Landing), Calif., showing the deep sinus, the ventral line of which is not confluent with the pallial line.

Figs. 6, 8.—*Panomya arctica* (Lamarck): 6, from off Cape Cod, Mass.; 8, from Point Barrow, Alaska, shell broken at the hinge.

Fig. 7.—*Panomya ampla* Dall from Captain's Bay, Amaknak Island, Alaska, showing the pointed anterior and flaring posterior end. This specimen is squarely truncate but the majority are obliquely truncate in a direction opposite to that of *P. arctica* (see figs. 6, 8).

Magnification: All × .74.



Myacidae and Hiatellidae. Explanation on facing page.

Explanation of Plate 26

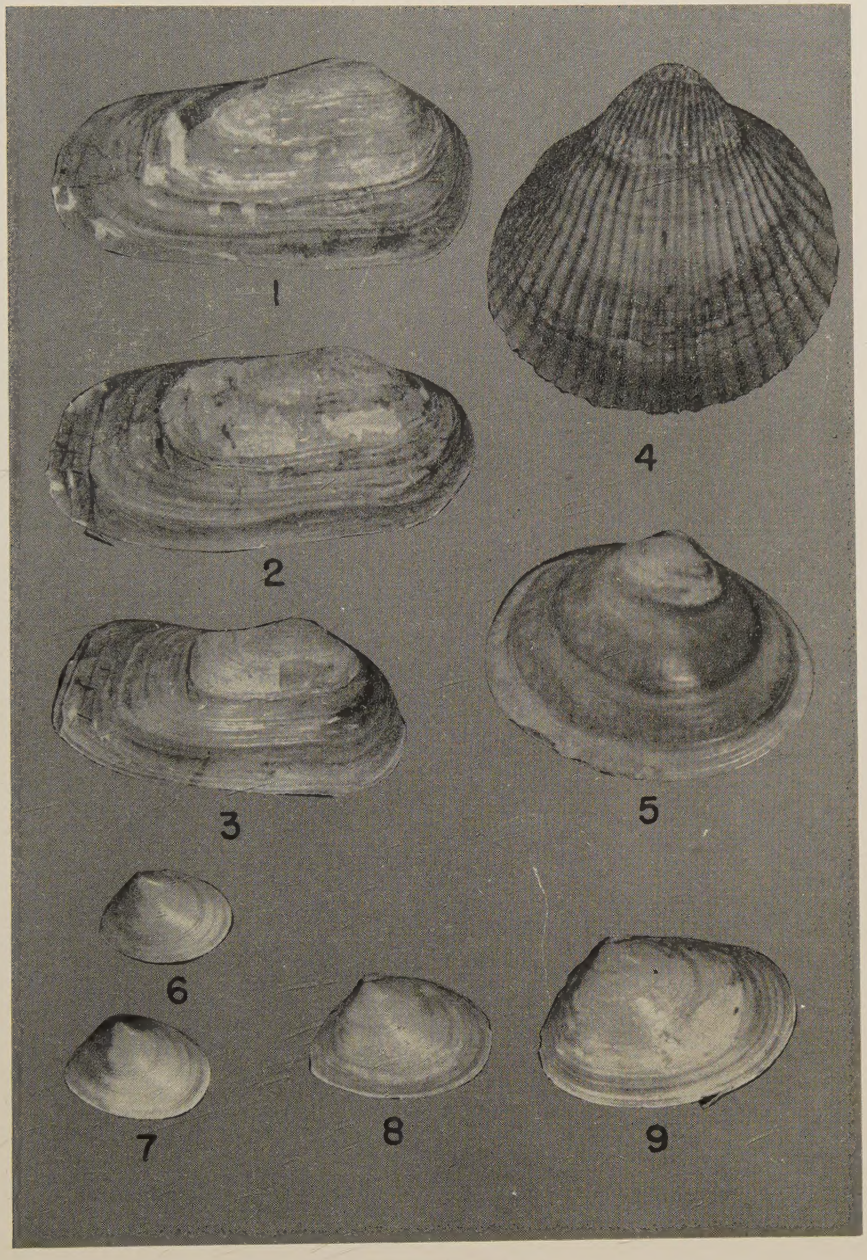
Figs. 1–3.—*Hiatella arctica* (Linnaeus) from 10 feet (Sept. 8, 1949), showing variations in anterior and posterior ends. (The elongate form most common at Point Barrow.)

Fig. 4.—*Clinocardium ciliatum* (Fabricius) from 110 feet (Sept. 8, 1948).

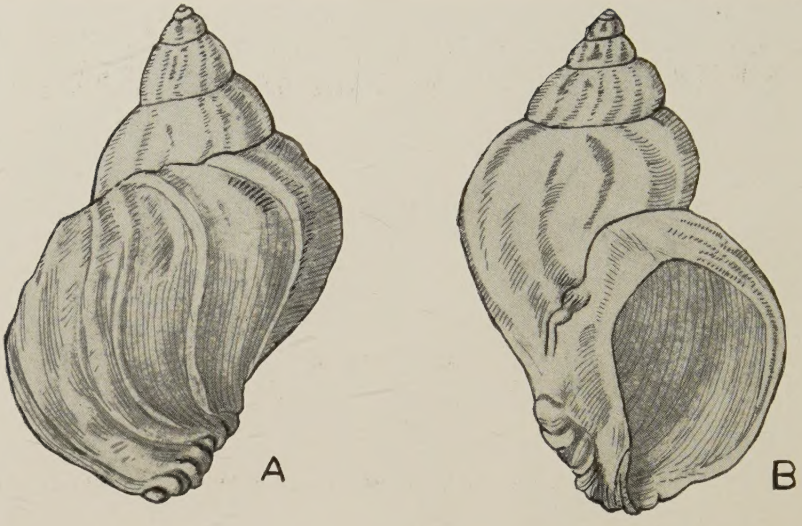
Fig. 5.—*Serripes grönlandica* (Bruguière) from 40 feet (Eluitkak Pass).

Figs. 6–9.—*Macoma calcarea* (Gmelin): 6–8, from 132 feet; 9, from 118 feet, showing variation in shape of anterior end and in proportion of height to length.

Magnification: All × 1.9.



Hiatellidae, Cardiidae, and Tellinidae. Explanation on facing page.



A retouched Contoura print of Hermann's *Buccinum solutum* (from Hermann, 1781, pl. 2, figs. 3, 4). Hermann gave no measurements, merely stating that the shell was about the size of an egg. This shell undoubtedly is a malformed lamellose *B. undatum* Linnaeus.